# Popular Astronomy.

Vol. XXXV, No. 9 NOVEMBER, 1927 Whole No. 349

## THIRTY-EIGHTH MEETING OF THE AMERICAN ASTRONOMICAL SOCIETY.

The thirty-eighth meeting of the Society was held on invitation of the president and secretary at the University of Wisconsin, Madison, from September 6 to 8, 1927. The members were located in the fraternity houses of Phi Delta Theta, Sigma Chi, and Sigma Alpha Epsilon, attractively located on the shore of Lake Mendota.

During the afternoon of Tuesday many of the visitors came in by automobile from all directions. On that evening was held the opening reception by Mr. and Mrs. Stebbins at the residence on Observatory Hill.

On Wednesday morning there was a session for papers in the main University building, Bascom Hall, but the members decided to hold subsequent sessions at the bottom of the hill in the attractive large living room of the Sigma Alpha Epsilon house. After a session in the afternoon the Society adjourned for an inspection of the Washburn Observatory, where perhaps the main item of interest was Burnham's famous six-inch refractor, now remounted but with the old mounting on exhibition as a historical relic. Wednesday evening was left open, and a few of the members attended the dinner of the mathematical societies, which were meeting in Madison during the same week.

Two sessions on Thursday finished up the scientific program, and in the afternoon the members were taken in cars around to the north shore of the lake for tea at the summer cottage of President and Mrs. Comstock, returning in time for the final dinner. The meeting was brought to a close by the usual set of after-dinner speeches, but an informal and musical group continued active until a late hour.

On Friday some of the members returned via Williams Bay to visit the Yerkes Observatory. On that day there was held a meeting of the Executive Committee of the American Section of the International Astronomical Union to organize committees in preparation for the meeting of the Union in Leiden in July, 1928.

The officers elected at the meeting are those whose terms in the following list begin in 1927; the others continue to serve unexpired terms.

| | | |
|---|---|---|
| President | George C. Comstock | 1925-1928 |
| Vice-Presidents | A. O. Leuschner | 1926-1928 |
| | J. S. Plaskett | 1927-1929 |
| Secretary | R. S. Dugan | 1927-1928 |

| | | |
|---|---|---|
| Treasurer | Benjamin Boss | 1927-1928 |
| Councilors | H. C. Wilson | 1925-1928 |
| | W. H. Wright | 1925-1928 |
| | C. E. K. Mees | 1926-1929 |
| | E. C. Slipher | 1926-1929 |
| | R. H. Curtiss | 1927-1930 |
| | Margaret Harwood | 1927-1930 |
| Ex-Presidents | Frank Schlesinger | |
| | W. W. Campbell | |

Members of the Division of Physical Sciences, National Research Council:

| | |
|---|---|
| Joel Stebbins | 1925-1928 |
| C. G. Abbot | 1926-1929 |
| Frank Schlesinger | 1927-1930 |
| Walter S. Adams | 1928-1931 |

The following persons were elected to membership, making a total of four hundred forty-three in the Society:

Harold F. Balmer, Goodsell Observatory, Northfield, Minnesota.
C. E. Bardsley, Box 723, Rolla, Missouri.
Sterling Bunch, 1520 Lagonda Avenue, Ft. Worth, Texas.
Yu-che Chang, Yerkes Observatory, Williams Bay, Wisconsin.
Willard J. Fisher, Harvard College Observatory, Cambridge, Mass.
Willard H. Garrett, Baker University, Baldwin, Kansas.
Frank S. Hogg, Harvard College Observatory, Cambridge, Mass.
Margaret K. Holbrook, Whitin Observatory, Wellesley, Mass.
Michel Kovalenko, Swarthmore College, Swarthmore, Pennsylvania.
Horace C. Levinson, 5485 Cornell Avenue, Chicago, Illinois.
Morris Liferock, U. S. Naval Observatory, Washington, D. C.
Allan D. Maxwell, Detroit Observatory, Ann Arbor, Michigan.
G. W. Moffitt, Yerkes Observatory, Williams Bay, Wisconsin.
William W. Morgan, Yerkes Observatory, Williams Bay, Wisconsin.
Alexander Pogo, Yerkes Observatory, Williams Bay, Wisconsin.
Howard S. Rappleye, U. S. Coast & Geodetic Survey, Washington, D. C.
Helen B. Sawyer, Harvard College Observatory, Cambridge, Mass.
Frances L. Seydel, Detroit Observatory, Ann Arbor, Michigan.
W. F. H. Waterfield, Harvard College Observatory, Cambridge, Mass.

Members of the Society present at the Madison meeting were:

| | | |
|---|---|---|
| S. Albrecht | G. C. Comstock | W. H. Garrett |
| W. E. Anderson | C. C. Crump | C. M. Huffer |
| H. F. Balmer | J. H. Darling | R. C. Huffer |
| W. O. Beal | R. S. Dugan | W. R. Jewell |
| Maude Bennot | J. C. Duncan | M. Kovalenko |
| Harriet W. Bigelow | O. L. Dustheimer | J. Kunz |
| N. T. Bobrovnikoff | C. T. Elvey | K. Laves |
| B. Boss | E. A. Fath | O. J. Lee |
| E. W. Brown | J. W. Fecker | Hazel M. Losh |
| Y. C. Chang | P. Fox | E. S. Manson |
| C. A. Chant | E. B. Frost | G. W. Moffitt |

| | | |
|---|---|---|
| W. W. Morgan | J. H. Pitman | J. Stebbins |
| D. B. McLaughlin | A. Pogo | O. Struve |
| G. F. Paddock | E. D. Roe, Jr. | F. D. Urie |
| J. Pawling | F. Slocum | G. Van Biesbroeck |
| E. C. Phillips | E. Smith | E. L. Williams |

The next meeting of the Society will be held at Yale University in December, 1927.

## ABSTRACTS OF PAPERS

### ON THE SPECTRA OF COMETS.

By N. T. Bobrovnikoff.

The spectra of twenty-two comets which were obtained during the period from 1908 to 1927 at the Yerkes Observatory with the Zeiss 6-inch ultra-violet camera and objective prisms have now been studied photometrically. A self-registering microphotometer with a thermopile was used for this purpose. The spectrum of comet 1927 *d* (Stearns) was observed visually at a heliocentric distance 3.7 astronomical units.

Evidence for existence in the comets of two distinct types of continuous spectrum is obtained. One spectrum has its maximum of intensity near λ4700 and has been called "the solar-type spectrum." The other with its maximum at about λ4000 has been called "the violet-type spectrum." A correlation between the heliocentric distance of the comet and the type of the continuous spectrum was established. At $r < 0.7$ astronomical units the solar spectrum is usually predominant, at $r > 0.7$ the violet. No definite correlation between the type of the spectrum and the phase-angle of the comet was found.

Sudden changes in the spectra of the comets were studied, especially in comet Delavan (1914 V). Similar changes in the spectrum of Halley's comet were described in a previous publication. Spectra of different parts of the comet were isolated and compared with direct photographs. Two cases of contradiction to Bredichin's theory of cometary forms were found: Comets Delavan and Gale (1912 II) had the same spectrum for both tails.

Reasons were given in favor of the fluorescent origin of the cometary spectrum.

### ON THE VARIABLE ROTATION OF THE EARTH.

By Benjamin Boss.

The amplitude of the periodic term in right-ascension of the form $A \sin \alpha + B \cos \alpha$ bears a strong correlation to the minor fluctuations of the moon's motion, suggesting a common physical cause. Interpreted

on this basis, the rate of rotation of the earth is subject to annual variation.

Treating the Greenwich moon observations, a periodic variation following the sidereal month was disclosed.

Taken in conjunction, the annual and monthly periods suggest a diurnal variation in the rate of rotation of the earth. While there is evidence of diurnal changes, as shown by clock corrections, the latter contain factors which must be eliminated before definitive results can be obtained.

It is suggested that the physical cause for the phenomenon may be found in tidal action upon the body of the earth.

## GRAVITATIONAL EFFECTS IN SPIRAL NEBULAE.

By Ernest W. Brown.

An account was given of some preliminary investigations into gravitation potentials suitable for spiral nebulae, on the assumption that the latter consisted mainly of stars between which collisions were very infrequent. It was also assumed that the principal part of the motion of each star was in a circle and that in a first approximation the nebula rotated like a rigid body. It appeared that the equiangular spiral forms of the arms could be preserved for long periods of time and that under certain conditions the arms would gradually close and in others would open. These potentials involved less difficult assumptions to account for the arms than those made by the author in an earlier paper.

## SPECTROSCOPIC OBSERVATION OF $\phi$ PERSEI.

By O. L. Dustheimer.

The study of the spectrum of $\phi$ Persei has been the subject of several detailed investigations. Important papers have been written by Ludendorff, Cannon, Jordan, Lockyer and Fredette, each of which has added new information in regard to this erratic star. The writer measured 162 Ann Arbor spectrograms, taken with a one-prism spectrograph attached to the 37½-inch reflector between October, 1911, and December, 1925. The main conclusions of the former investigators of $\phi$ Persei have been verified. The velocity-curves for hydrogen absorption by Ludendorff, Cannon, and Jordan have been confirmed. The general contour of Jordan's emission-curve was verified but the center-of-mass axis was found to be 11 km greater for the Ann Arbor measures than those of the Allegheny spectrograms. A new helium velocity-curve was obtained which is similar to the hydrogen velocity-curves. The primary and secondary maxima as well as the minima occur at about the same phases as the change in the absorption and emission cu ves.

The measures of 608 spectrograms were used in obtaining a new period of 126.626 days for $\phi$ Persei. This result is a rather good mean of the periods obtained by Ludendorff, Cannon, Jordan, and Lockyer. In determining this period observations over a range of eighty complete cycles were used. Normal places were formed from the measures of the [H] and [K] lines of calcium and a new $K$ derived from the plotted calcium curve. There is a slight tendency for the [K] line of calcium to follow the other curves. The [H] of calcium was hard to measure on account of its blend with H$\zeta$.

Ludendorff also found fine lines which at times appeared double. Jordan noted a few of these on the Allegheny plates but never double. The Ann Arbor results verify Jordan's findings in this respect. Individual intensity-curves for the ratio of the red to the violet components of the hydrogen emission bands were obtained. The general character of these curves is similar to the velocity-curves derived from the central absorption and emission of hydrogen. The Ann Arbor measures show a much greater range for the secondary curve and also suggest that the secondary maximum and minimum occur about 6 days later than is indicated by other observers. From this it appears that the secondary maximum is decidedly variable and that the phases at which the secondary maximum and minimum occur are changeable.

Binary motion will take care of some of the changes taking place in $\phi$ Persei but it will not account for all the observed phenomena. One of the most reasonable explanations of the changes in the spectrum of this star is that it pulsates, contracting and expanding in a period of 126.626 days. According to the pulsation hypothesis, the layer of gas giving rise to the emission bands in $\phi$ Persei pulsates through a narrower range than the higher layer producing the narrow hydrogen absorption lines. A second pulsation of shorter period and smaller range would account for the secondary maximum and minimum so pronounced in the velocity-curve of this star.

## STELLAR PARALLAXES FROM THE DEARBORN OBSERVATORY.

By Philip Fox and Maude Bennot.

At the Hanover meeting of the Society in 1924 some studies of the Dearborn Observatory parallaxes were presented. These studies have now been reviewed and extended using revised and corrected values for the parallaxes. There are now available for comparison modern trigonometric determinations for 112 of our fields, with a total of 228 comparisons. For 65 fields we find other determinations greater than ours. For 47 fields ours exceed the others. For 130 comparisons our values are in excess; for 98 they are smaller. A few of the values of our list must be considered as provisional as they are for stars originally used for comparison stars and for which motion was detected during the

course of the reductions. Some of them are ill placed on the plates, far from the centroid of the remaining comparison stars. If we discard the comparisons for six such stars, the average difference in parallax for all remaining comparisons is 0".009, with Dearborn Observatory parallax in excess.

Various tests were made to see if the differences in parallaxes were dependent on other variables. No dependence was indicated for right ascension of the field, average hour angle, number of seasons, or spectral type. The relation of difference in parallax depending on difference in magnitude of the parallax star and mean magnitude of the comparison stars is still indicated, though the slope of the line through the platted points is reduced. In the formula, $y = a + bx$, where $x$ is the difference in diameter in millimeters between the parallax star and the mean diameter of the comparison stars ($0.1\,\text{mm} = 1.6\,\text{mag.}$) and $y$ is the correction to the parallax to reduce the value to the system of the parallaxes used in the comparison, $a = +0.0003$ and $b = -0.4118$. The earlier discussion made $a = +0.004$ and $b = -0.444$. An explanation of this relation is not apparent, but the diminished differences with the increased number of comparisons suggests that with more comparisons the apparent systematic difference might vanish.

The average probable error using all fields is 0".0105; discarding the six noted above, it is 0".0096.

## THE BARNARD ATLAS OF SELECTED REGIONS OF THE MILKY WAY.

By Edwin B. Frost.

An advance copy of "A Photographic Atlas of Selected Regions of the Milky Way" by the late Professor Edward Emerson Barnard, was exhibited to the Society. It is issued in two Parts, separate volumes, and is No. 247 of the *Publications of the Carnegie Institution of Washington*. Part I contains fifty-one photographic prints of the selected areas of size about 10 by 10 inches, each of which is faced by Professor Barnard's description of the picture, compressed into one page. An Introduction describes the Bruce telescope and gives many notes on the subject of celestial photography as they had been written down at various times by Mr. Barnard. It also contains a list of 349 dark objects, including the list of 182 originally published by Barnard in the *Astrophysical Journal*. A fine photogravure of Professor Barnard forms the frontispiece of Part I.

Part II contains for each region a key chart drawn by Miss Calvert on exactly the scale of the photograph, and provided with coördinates for the ready location of objects of interest. Many of these objects, including the dark markings are also numbered on the key chart. On the page facing the key chart, is a table collecting all the essential in-

formation regarding these numbered objects, and listing again the principal dark objects in that region. It is intended that the users of the Atlas shall have open before them Part I and Part II to the same region at the same time, and then all the data available for that area will be before them, without any turning of pages.

The work has been edited and prepared for publication by Edwin B. Frost and Mary R. Calvert of the Yerkes Observatory. It is expected that it will be ready for distribution by the Carnegie Institution of Washington during the present autumn.

## NEW DEMONSTRATION EQUIPMENT FOR ASTRONOMY TEACHERS.

By H. W. Geromanos.

There were exhibited models or slides of new apparatus, including a planetarium, a spectra demonstrator, a momentum apparatus, and a precession-of-equinox model. (Ed.)

## A PHOTOMETRIC SURVEY OF RED STARS.

By C. M. Huffer.

A study of stars of Class M has been undertaken with the photoelectric photometer of the Washburn Observatory, the observations being divided between Mr. Stebbins and the writer. Stars brighter than visual magnitude 6.0 were selected from Volume 50 of the *Harvard Annals*, one or more stars of class M being compared in a group with stars of Class K or G.

Table I.

| Absolute Magnitude | Stars Tested | Stars Variable | Per Cent Variable |
|---|---|---|---|
| −4.3 to −1.2 | 7 | 7 | 100 |
| −1.1 " −0.5 | 11 | 5 | 45 |
| −0.4 " −0.2 | 22 | 9 | 41 |
| −0.1 " +0.1 | 45 | 11 | 24 |
| +0.2 " +0.7 | 19 | 0 | 0 |
| Total | 104 | 32 | 31 |

Table II.

| Spectrum | Stars Tested | Stars Variable | Per Cent Variable |
|---|---|---|---|
| M0 | 15 | 1 | 7 |
| M1 | 14 | 0 | 0 |
| M2 | 33 | 8 | 24 |
| M3 | 20 | 6 | 30 |
| M4 | 11 | 7 | 64 |
| M5 | 8 | 8 | 100 |
| M6 | 3 | 2 | 67 |
| M0 to M6 | 104 | 32 | 31 |
| G0 to K5 | 101 | 3 | 3 |

Table I gives the number of variable stars arranged according to their absolute magnitudes. Table II shows the percentage of variation according to the class, using the recent Mount Wilson classification. Stars with a range as great as 0.10 magnitude or more have been marked as variable.

It was suggested to us by Dr. W. S. Adams that the red stars might show a variation which would depend on the absolute magnitude. From Table I it is evident that this is the case. The seven stars brighter than absolute magnitude —1.1 are all variable. Among these are included five known variables: $\alpha$ Orionis, $\mu$ Cephei, $\psi^1$ Aurigae, $\alpha$ Herculis, and R Lyrae. Their variations are greater than one-quarter of a magnitude. The other 27 stars, with two exceptions ($\eta$ Geminorum, and g Herculis) vary from 0.1 to 0.25 magnitude and were unknown as variables before this study was begun. From this it appears that of the stars tested all of Class M having absolute magnitudes brighter than —1.1 are variables, one-third from —1.1 to 0.0 are variables, and only one M star fainter than absolute magnitude 0.0 was found to vary, and that by only 0.1 magnitude.

Our anticipation that many red stars of advanced type would be variable has likewise been confirmed. Nearly forty per cent of the M stars examined whose class is M2 to M6 are variables, whereas only one star of class M1 or M0 was found to be variable. That exception was $\psi^1$ Aurigae whose absolute magnitude is —2.7, class M10.

## THE VELOCITY-CURVES AND PERIOD OF $\zeta$ TAURI.

By Hazel Marie Losh.

A new period of 133 days was determined for $\zeta$ Tauri from the observations at the Detroit Observatory in 1914, 1923-24, and 1926-27, and by Adams at the Yerkes Observatory in 1902-05. The mean curve was based upon the velocities derived from the hydrogen lines on the plates of 1923-24 and 1926-27. The 1914 observations did not extend over a long enough period of time to determine accurately the velocity of the center of mass for that cycle, and therefore were not included in the mean curve. The range in the velocities derived by Adams from the measurement of H$\gamma$ alone was greater than for the velocities determined at the Detroit Observatory, and therefore could not be included in the mean curve.

The form of the mean velocity-curve is quite irregular. This velocity-variation may be due to vertical motions of the atmosphere in a period of 133 days, or it may possibly be better explained by a combination of atmospheric and orbital motions.

Assuming an elliptical curve through the observations, the following preliminary elements were obtained:

$P$ = 133 days
$\mu$ = 2°.7068
$T$ = 13.4293 days (Phase)
$\omega$ = 317° 3'.6
$e$ = 0.308
$\gamma$ = +29.80 km/sec.
$K$ = 10.5 km/sec.

## THE MASSES AND LUMINOSITIES OF ECLIPSING BINARIES.

By Dean B. McLaughlin.

Radii, masses, and densities are calculated for forty-one eclipsing binaries by combination of photometric and spectrographic data, and the adoption of hypothetical mass ratios for ten stars in which only one spectrum has been measured. Mean masses for pairs of several spectrum groups are as follows:

O 8.5, 70⊙; B0-B2, 30⊙; B3-B5, 8.9⊙; B8-A0, 6.4⊙; A2-A8, 5.3⊙; F0-F5, 1.2⊙; F8-G5, 2.1⊙; M1, 1.2⊙.

Bolometric absolute magnitudes are calculated and plotted against mass on an Eddington diagram. Many stars show very large residuals. Five stars of well determined mass are so far from the curve that no reasonable allowance for errors of observation will bring them near it. These are S Antliae, RX Herculis, RS Canum Venaticorum, TV Cassiopeiae, and $\beta$ Lyrae.

A mass-luminosity relation carries with it a mass-density relation for any given effective temperature. In this manner it is shown that the above-mentioned stars would require an eight-fold or greater change of density to place them on the mass-luminosity curve. The change of radius necessary to effect this would do violence to the photometric observations.

It is concluded that the eclipsing binaries indicate that the mass-luminosity relation is statistical, and not individual.

## THE SPECTRA OF JUPITER AND SATURN.

By Donald H. Menzel.

It was pointed out several years ago, by the author, that the banded spectra of the giant planets are of considerable interest, astrophysically. The correspondence between the individual spectra is, apparently, sufficient to justify the assumption that the bands arise from a common origin, presumably a molecule which is still dissociated at very low temperatures. The great increase in the intensity of absorption, from Jupiter to Neptune, is analogous to the strengthening of the titanium oxide bands in low temperature stars, the sole difference being the relative critical dissociation temperatures of the absorbing material. The

recent radiometric observations of these planets have disclosed no evidence of high surface temperature, as formerly postulated, these new results being in harmony with the fact that the bands are strengthened with increasing solar distance, as if solar radiation alone were responsible.

Accepting the foregoing reasoning as true, it follows that local differences of temperature upon the surface of any planet will be attended by stronger bands in its spectrum. Hence the limbs, which would naturally be the cooler, should exhibit heavier absorption and if, in spite of rapid rotation, there be any considerable cooling during the night, the east limb should show the most marked effect.

Visual spectra of both Jupiter and Saturn, taken with the 36-inch refractor, apparently agree in showing the bands much stronger upon the east limb. In both cases, however, spectra were not obtained until after opposition, so that the western terminator could not be observed. The asymmetry of the bands, however, is greater than the phase angle. Corresponding spectra, taken before opposition, will settle the question of the reality of the phenomenon of relative limb intensities. Aside from this, the fact that the bands are strengthened at the edge is of interest. It is not possible, at present, to estimate how much of the difference is due to increased atmospheric depth and how much to lower temperature, but, from the magnitude of the observed effect, it seems probable that the latter cause is at least appreciable.

## SPECTROSCOPIC AND PHOTOMETRIC OBSERVATIONS OF CP CYGNI.

By W. W. Morgan.

It is important to determine the shortest period possible for an eclipsing binary of spectral type A. Only two such stars are known having a period less than half a day, T Sextantis and CP Cygni. There is a question as to whether the period of T Sextantis should not be doubled.

Twenty-one spectrograms of CP Cygni obtained with a new short-focus camera on the Bruce spectrograph of the forty-inch telescope fail to show any change in radial velocity over half the period published by B. Okouneff. A single line, Magnesium 4481, was measured.

Twenty extrafocal exposures with the 136-mm Zeiss ultra-violet camera fail to show any change in brightness. The mean deviation for one series of ten exposures is $0^{M}.023$.

The published period, $0^{d}.4984$, almost exactly half a sidereal day, was derived from visual estimates by Selivanoff, Tsessevitch, and Okouneff. As there are only two comparison stars near enough in brightness to allow accurate estimates of the supposed variable to be made, and as CP Cygni is brighter than either one, it seems that the observed variation was an effect of hour angle.

## GRAPHICAL DETERMINATION OF ORBITS OF VISUAL BINARY STARS.

By J. J. Nassau and P. D. Wilkins.

A method is developed for determining the orbits of visual binary stars which requires, in general, observations for at least one period. From the given data, two figures are drawn in rectangular coördinates. The first shows position angle plotted against time, and the second, distance against time. A third figure, distance against position angle, is drawn from the first two figures. Two equal distances differing in position angles by 180° are each the projection of the semi-latus rectum of the real ellipse. From Figure 3 these are obtained with their corresponding position angles. The corresponding time is obtained from Figure 1 and then transferred to Figure 2. The bisection of this interval, with the bisection of the remaining interval within one period, in Figure 2, yields the times of the periastron and apastron passages. The position angles of the projections of the periastron and apastron distances are now obtained from Figure 1.

From these two projections, the eccentricity of the real orbit is found. If the proper interval is added to and subtracted from the time of periastron passage, the time of passage of the companion star over the extremities of the minor axis of the true orbit is found, and Figure 2 gives the projections of the distances from the primary star to the extremities of the minor axis of the real ellipse. This will yield the length of the projected minor axis. The solution is now well adapted to Zwier's equations.

The proposed method furnishes a simple and effective determination of the orbits of visual binary stars without basing the solution on the drawing of the apparent ellipse, while it makes full use of the time element.

To illustrate the method the orbit of 70 Ophiuchi was computed.

## PERSONAL EQUATION IN OBSERVING OCCULTATIONS.

By E. C. Phillips.

In this paper there was described an apparatus for producing and recording artificial occultations; the methods of using the apparatus for determining the lag of an observer in recording the occultations were briefly outlined and the following results were indicated.

For disappearance at the dark limb when it is rendered visible by reflected earth-shine the lag is smallest and for the two observers using the apparatus amounted to 0.25 sec. and 0.29 sec., respectively.

For disappearance at the dark limb when this is invisible, the lag was found to be 0.29 sec. and 0.32 sec., respectively.

For disappearance at the bright limb the lag was found to be 0.33 and 0.32 sec., when the observing conditions were made favorable; in case of poor conditions involving excessive glare in the field the observations become correspondingly poor and precede or follow the actual time of disappearance by 2 or 3 seconds.

In all the above cases the disappearance was recorded on the chronograph with the usual observing key. The average deviation of individual observations from the mean values given above was 0.03 sec.

When a stop-watch was used the lag was found to be negative, that is the observed time of disappearance was about 0.25 sec. earlier than the actual time. Investigation showed that this was due not to a personal equation of the observer but to the action of the watch itself which besides having an error of eccentricity seemed to start more promptly than it stopped.

The above results depend on admittedly meagre experimental data, about 210 observations in all, and hence are presented as preliminary only; they are, however, considered as giving fairly accurate values for the lag involved in the use of a key and chronograph. The stop-watch results need much more extensive investigation.

## PHOTOGRAPHS OF VENUS.

By Frank E. Ross.

During the past summer, 1927, the writer photographed Venus with the Mount Wilson 60-inch and 100-inch reflectors, through various filters from ultra-violet to infra-red. The ultra-violet pictures showed markings, both dark and bright, which varied from night to night. On June 26, a sharp wedge-shaped marking was photographed, which appeared to remain stationary over an interval of one hour, accordingly suggesting a slow rotation-period for the planet. In general the markings were dark bands perpendicular to the terminator, strongly suggestive of the belts of Jupiter, several sometimes appearing on one night. On June 6, an extended bright cloud covered the region around the south point. Both the south and north points appeared to be the region of bright clouds, the dark bands confining themselves to the central portions of the disc, extending from the terminator to the edge at times.

No markings were seen visually, although they were carefully searched for each night. This agrees with the photographs, for the negatives made through blue, red, and infra-red filters gave not a trace of the markings.

## THE VAN VLECK OBSERVATORY EXPEDITION TO NORWAY FOR THE ECLIPSE OF JUNE 29, 1927.

By Frederick Slocum.

The path of totality of this eclipse crossed England, Norway, and Sweden. Weather records indicated that the probability for clear sky

was highest for the central valleys of Norway, so it was decided to locate at Aal in Hallingdal, on the Oslo-Bergen railroad. We planned to concentrate on the structure and photometry of the corona. Four cameras of 3 inches aperture and 12 feet focal length were mounted on a single polar axis driven by a heavy clock. Two short focus cameras were to be used without clockwork. Standard squares were to be impressed upon all plates for determining the photometric constants in connection with the study of the distribution of light in the corona. A King "pin-hole" photometer for measuring the integrated light of the corona was also to be used. Lantern slides of the location and of the apparatus were shown. The sky was totally cloudy on the day of the eclipse, and no plates were exposed.

## MERIDIAN-CIRCLE OBSERVATIONS OF EROS COMPARISON STARS.

By Elliott Smith.

The asteroid Eros at its near approach to the earth in 1930-31 moves eastward among the stars along nearly the same parallel of declination through about four hours of right ascension; it then turns quite abruptly and follows the same meridian southward through more than sixty degrees with deviations either way of about thirty minutes in right ascension. Meridian circle observations of Eros reference stars for the first section of this path present no unusual difficulties but a large number of observing nights is required for the second section, as the reference stars here have such a wide range of declination within narrow limits of right ascension.

Two lists of Eros reference stars have been published for which meridian circle observations are desired. The first list contains 419 stars for the section of its path in which its motion is eastward, the second list 402 stars for the section of its path in which its motion is nearly southward. The stars of the first list are distributed through more than five hours of right ascension with comparatively little variation in declination, while those of the second list are included within an hour and six minutes of right ascension. The last hour of the second list contains 335 stars. The lists were prepared with the object in view of having two stars to each square degree in the region of sky through which Eros will pass.

In November, 1926, Professor A. Kopff, who prepared and published these lists, wrote the Cincinnati Observatory requesting that we undertake a part of the observations of the second list. We accordingly agreed to observe the stars between 0° and —10° declination.

There are 63 stars within this range of declination included within 18½ minutes of right ascension. In ten nights of observing all but two stars of this list were observed this spring. One of these was marked as too faint for our instrument, the other as difficult because of its

faintness. Dr. Yowell read the microscopes and recorded the observations while I made the transit observations. In this way we were able to observe stars from one to two minutes apart.

The magnitude of these stars, as published, range from 7.0 to 9.7, but according to my estimates several of the stars are visually brighter than the magnitudes given while a few are fainter. The stars marked as faint for our instrument were given as of magnitudes 9.5 and 9.3 while the one given as the faintest, 9.7, was observed without difficulty.

The same B.J. stars were used as comparison stars on each night of observing and screens were employed to reduce their magnitudes to the mean of the Eros stars observed.

## TESTS OF THE SOLAR VARIATION BY PHOTOMETRIC MEASURES OF URANUS.

By Joel Stebbins and T. S. Jacobsen.

The photometric measures of the satellites of Jupiter made at the Lick Observatory in 1926 were continued there in the summer of 1927. Measures were also made of Uranus which was close to Jupiter in the present season. It was expected that Uranus would show the variation of about 0.15 magnitude in a period of 0.45 day, detected by Leon Campbell and announced in *Harvard Circular* No. 200, 1917, but this variation was not found. The light was practically constant during two months and more, the probable error of an observation being less than 0.005 magnitude. If further measures confirm this result it is evident that Uranus will be a first class object for tests of the solar variation. The work began in July and will continue through the oppositions of Jupiter and Uranus until October, 1927.

## A MODIFIED FORM OF THE PROJECTION METHOD FOR THE REDUCTION OF SOLAR PHOTOGRAPHS.

By Harlan True Stetson.

At the solicitation of the Weather Bureau four stations are now co-operating through the U. S. Naval Observatory in the daily photography of the sun's surface, deducing the heliographic positions of all visible spots and forwarding to Washington such positions and measured areas as may be needed and can be furnished for those days on which local data are not available. Besides the Naval Observatory the stations co-operating are the Mount Wilson Observatory, Yerkes Observatory, and the Harvard Astronomical Laboratory.

The photographs taken at the Harvard Laboratory give a solar image some six centimeters in diameter and it is for the determination of the heliographic coördinates of spots on these plates that we have found a

modified form of the globe scheme introduced by Hale exceedingly serviceable and convenient.

It will be recalled that the method used by Hale was to project optically the negatives of the solar image upon a steel sphere having a surface ruled with a graving tool into spherical coördinates one degree apart. When the photographic image of the sun is projected on to a sphere with properly oriented axis, and placed at the appropriate distance, it becomes at once possible to read off the original spherical coordinates of every spot.

In place of the steel ball used by Hale, we make use of a well made white globe with a matt celluloid finish upon which marks can be made and erased with perfect satisfaction. The globe is eight inches in diameter and is mounted in a supporting ring graduated into degrees. This supporting ring is in turn mounted in a fork support which may be adjusted about a vertical axis by the amount necessary to allow for the tip of the solar pole to or from the earth. The angle of inclination of the sun's axis to the fundamental plane perpendicular to the line of sight is given in the *Ephemeris* as is also the position angle of the solar axis with respect to the north and south line.

The adjustment of the axis of the globe for the latter inclination or position angle with the north and south line is effected by turning the supporting ring in the fork which supports it. The graduations on a horizontal circle facilitate the adjustment of tilt with respect to the fundamental plane whereas the graduations of the supporting ring of the globe itself allow for accurate orientation of the axis in position angle.

When the axis of the globe has once been adjusted to correspond to that of the sun for the day in question, the photographic negative is placed in the projecting lantern with the east and west line vertical and the image of the solar disk cast upon the globe. The size of the image is always made to fit the globe exactly by adjusting the distance of the globe from the lantern in conjunction with the focusing of the projecting lantern itself in the usual way. In this way compensation is provided for the change in the apparent diameter of the sun throughout the year.

With the solar image projected onto the globe the centres of all visible spots can be accurately located with a sharp pointed pencil and numbered in any sequence or date desired. It is usually possible to mark on the globe the position of spots from several negatives taken on successive days without confusion.

As soon as all the spots have been located for a given day or series of days, a solar meridian is carefully drawn along the edge of the brass supporting ring which will make possible the resetting of the globe to the same identical position or for any other longitude of sun's centre that may be desired. The globe thus marked together with its supporting ring is then removed from the supporting stand and placed in a

precision mounting accurately machined and with a horizontal circle reading by degrees from 0° to 360°. The globe and ring are placed in the stand so that the axis of the globe is perpendicular to the horizontal circle. The position of the pole is read directly from the brass supporting ring.

The globe is then rotated in its stand until each spot in turn is brought under the meridian ring from which the heliocentric latitude is at once read directly to the nearest degree and by estimation to the nearest tenth of a degree. The difference in heliographic longitude is obtained at the same time by noting the movement of the fiduciary meridian with respect to the horizontal circle reading which again may be read directly to the nearest degree and by estimation to the nearest tenth of a degree. The reduced values are referred to the meridian passing through the centre of the sun's disk and are expressed to the nearest degree. By such an arrangement it is possible in a short time to make several independent setups, reversing the plate meanwhile, thus automatically checking the postions and reducing the probable errors of reading as desired.

Actual tests show that results obtained by this method compare favorably with the results obtained from the same plates when a Gaertner comparator is used for measurement and the measures reduced in accordance with the rigorous method employed at Greenwich. Present observations indicate a probable error well under one degree.

## THE SPECTRUM OF NOVA AQUILAE 1927.

By Otto Struve.

Slit-spectrograms of Wolf's recent nova in Aquila were obtained with the Bruce spectrograph of the Yerkes Observatory on September 1.13, September 2.15, and September 5.16 U.T. A new camera-lens designed by Mr. Moffitt and giving a linear dispersion 127 A per mm at λ4500 was used. The exposure times ranged from ninety minutes to four hours and fifteen minutes.

The spectrum shows the usual emission bands characteristic for the nebular stage in the development of a nova. On an Eastman 40 plate and with the usual focus-setting of the 40-inch telescope the strongest band is Hβ; λ4640 is decidedly weaker and has diffuse edges, while nebulium I is third in intensity. The comparatively strong emission at λ4686 is peculiar. An absorption line seems to be present near its violet edge. Another narrow absorption line is suspected in the center of bright Hδ. On the composite band Hγ and λ4364 there are at least two absorption lines visible with certainty. The details of the measurements against the titanium and iron comparison spectra are tabulated below. The photographic magnitude of the nova was determined by Mr. W. H. Garrett as 9.4 on Aug. 21; 10.0 on Sept. 2 and 10.1 on Sept. 4. The

photovisual magnitudes for the same dates were 9.2; 10.1; 10.4. My own visual estimate in the finder of the 40-inch telescope was 10.2 on Sept. 1 and 2. The nova had a distinctly reddish color. This seems paradoxical if contrasted with the negative color-index found by Mr. Garrett on Sept. 2 and 4. However, the yellow filter used by him for the photovisual magnitudes does not transmit Hα. The red appearance is thus almost certainly due to a strong Hα emission band, with little or no radiation from the yellow part of the spectrum.

It was stated by Shapley in *Harvard Announcement Card* 31, that objective prism plates taken with an 8-inch telescope on August 16 and 17 showed λ4640 strongest. Provided that the emulsion used was of the ordinary photographic type similar to Eastman 40 (used here), the character of the spectrum has changed between that date and September 1. There is no certain evidence of any change between Sept. 1 and 5.

| Violet Edge | Red Edge | Mean Emission | Mean Absorption | Probable Origin |
|---|---|---|---|---|
| 4090.7 | 4112.8 | 4101.8 | 4101.8 | Hδ 4101.7 |
| 4332.6 | 4351.2 | 4341.9 | ..... | Hγ 4340.5 |
| ..... | ..... | ..... | 4352.5 | ? |
| ..... | ..... | ..... | 4358.2 | ? |
| 4363.0 | 4375.8 | 4369.4 | ..... | Neb. ? 4363 |
| 4584.5 | 4616.4 | 4600.4 | ..... | Neb. 4605 |
| 4621.6 | 4658.9 | 4640.2 | ..... | N+ 4640 |
| 4673.3 | 4696.2 | 4684.8 | 4670.5 | He+ 4685.8 |
| 4707.4 | 4721.2 | 4714.5 | ..... | Neb. 4712 |
| 4850.8 | 4876.3 | 4863.6 | ..... | Hβ 4861.3 |
| 4913.8 | 4934.6 | 4924.2 | ..... | He 4921.9 |
| 4947.5 | 4971.0 | 4959.2 | ..... | Neb. II 4958.9 |
| 4995.3 | 5022.7 | 5009.0 | ..... | Neb. I 5006.8 |

## ON THE K-TERM IN RADIAL VELOCITIES.

By Ralph E. Wilson.

It was pointed out by Campbell in 1910 that the mean peculiar radial velocity of the stars, taking account of sign, did not vanish as it should if the motions were at random. Rather large positive values of this quantity in spectral classes B, K, and M seemed to point to a real effect, which was interpreted by some investigators as evidence of an expanding universe. Since 1910 the number of radial velocities available has more than tripled and the representation of velocities of stars south of declination —30° has been materially strengthened, thus rendering less effective the purely statistical sources of error which may have entered into the earlier determinations of the K-term.

New determinations of the values of K, based upon 3761 radial velocities less than 50 km/sec. after correction for the solar motion, were made by two methods, the first in which the solar speed was left as an unknown with K, and the second in which the solar speed was taken from the first solution $V_\odot = -19.6$ km/sec., and the simple

mean K formed. The results are given in the accompanying table.

| Type | $V_\odot$ | P.E. | $K_1$ | $K_2$ | P.E. | ** |
|---|---|---|---|---|---|---|
| | km | km | km | km | km | |
| B0 - B5 | —20.2 | ±0.9 | +3.4 | +3.5 | ±0.6 | 384 |
| B8 - A3 | —16.8 | 0.8 | +0.5 | +0.5 | 0.5 | 675 |
| A5 - F5 | —18.7 | 1.0 | —0.1 | 0.0 | 0.6 | 521 |
| F8 - G5 | —17.4 | 1.2 | —1.1 | —0.9 | 0.6 | 670 |
| K0 - K2 | —18.0 | 1.0 | 0.0 | 0.0 | 0.6 | 941 |
| K5 - M | —25.5 | 1.3 | +1.1 | +0.9 | 0.8 | 513 |
| B8 - M | —19.2 | 0.51 | —0.06 | —0.04 | 0.29 | 3310 |
| All | —19.6 | 0.45 | +0.44 | +0.44 | 0.26 | 3761 |

These results indicate that the tripling of the data alone since 1910, with its consequent reduction of the purely statistical errors has practically eliminated the K-term from all the spectral classes except B, in which class, as others have shown, several causes may operate to produce a positive mean radial velocity.

## THE DEFINITIVE ORBIT OF COMET DELAVAN 1914 V.

By George Van Biesbroeck.

During its long period of visibility extending over twenty-one months this conspicuous comet has been abundantly observed. A new reduction has been made of all the observational material which consisted, after discarding measures of insufficient weight, of a total of 912 positions.

As starting elements the writer used those of a slightly hyperbolic orbit, obtained by him in 1915, which represented the measures to within 25″. After taking into account planetary perturbations a least-squares adjustment gave the final elements. The corrections to the starting elements are small: the perihelion passage, for instance, changes only by 3 minutes of time. The hyperbolic character of the orbit again comes out quite definitely: the value of $1/a$ is —1465 units of the seventh decimal with a mean error of 31. The main reason for the investigation was to find if the orbit would change its character by computing the perturbations sufficiently far backward and reducing the elements to the center of gravity of sun and planets. The perturbations in $1/a$ were computed backward to 1898 for Jupiter, for Saturn back to 1886. The final value of $1/a$ then becomes $+119 \pm 31$ units of the seventh decimal and from the run of its increase it seems probable that the change would be more than a couple of units until the ultimate value is reached. At this point the expression for the upper limit of the change given by Strömgren figures out 43 units. The value of $1/a$ was therefore originally positive and the comet must be considered as a permanent member of the solar system thus confirming a conclusion that has been reached for previous comets having shown reliable hyperbolic orbits in the vicinity of the sun.

However, to the last value of $1/a$ mentioned corresponds a semi-major axis of 84000 A.U. and the aphelion distance would be twice as much, so that the comet would have come from a distance almost of the order of that of the nearest stars.

## A TEST OF COMETARY REFRACTION BY PERIODIC COMET PONS-WINNECKE.

By George Van Biesbroeck.

Taking advantage of the close approach of Comet Pons-Winnecke to the earth in June of this year and its consequent large apparent diameter the writer has made a photographic test of the existence of a shift due to refraction through the coma. On June 22 a plate was exposed on the field of the comet with the 40-inch refractor. On June 27, the comet having left the field, the exposure was repeated on the same plate under identical conditions. Seventy-three star images down to magnitude 12 to 13 were found on the plate, each one represented by two exposures close together, one taken through the comet and the other free from its influence. The plate was measured in rectangular coördinates and a least-squares adjustment for scale and orientation from one set of images to the other was made without considering the influence that a possible systematic shift by refraction might have had on part of the stars. The residuals are plotted in size and direction as arrows giving the difference June 22 minus June 27. The field covers an extent of about 35′ on the side. The comet was a very plain object to the naked eye about one degree in diameter. It therefore covered the whole area of the plate. But the denser part of the coma was only 10′ in a nearly north south direction. An inspection of the arrows shows no indication of the systematic shift of the stellar images away from the center of the plate. The residuals appear equally erratic over the whole field. A systematic displacement of as little as 0″.10 would have shown very conspicuously. There does not seem to be a possibility of a shift larger than 0″.05 in the stellar positions even where the light of a star has passed through 100,000 kilometers of cometary material. The result is therefore strongly negative. Comet Pons-Winnecke has probably lost most of its gaseous elements in the course of its frequent returns to perihelion. It would be of interest to repeat this photographic test in the case of a large comet having a denser gaseous envelope.

## A REMARKABLE METEOR, CONNECTED WITH THE WINNECKE COMET, PHOTOGRAPHED AT MUKDEN, MANCHURIA.

By Issei Yamamoto.

During the latter half of last June, the writer was stationed at Mukden, Southern Manchuria, to observe the Pons-Winnecke Comet and the

meteors connected therewith, just outside the region of seasonal rains which prevail over the whole of Japan proper in that time. The observations of the comet were mainly photographic. The meteors were generally faint as sometimes expected. The evening of June 30 was exceptional, when a series of fairly bright meteors was observed; in fact, in every five minutes a meteor brighter than fifth magnitude was seen on the average. The full details of the present expedition will be published in future.

On June 29, at $23^h\ 51^m$, Japanese Western Standard Time, (June 29, $3^h\ 51^m$ P.M. in Greenwich Mean Time) an extraordinary bright meteor appeared in the low southwestern sky. The writer was then photographing the Scorpio-Ophiuchus region with a small camera, making use of a clock-driven 4-inch Zeiss equatorial as the guiding telescope. The purpose of this work was to get a plate for the two asteroids Ceres and Parthenope in a leisure time before the rising of the comet Winnecke. The light of the meteor was of so rare brightness that the writer instantly took the case for somebody's mischief in turning a flash-light to him who was guiding the telescope. Next moment the bright meteor was noticed which was then in its climax of luminosity. During about three seconds subsequently, the meteor flared up two or three times. The color was reddish yellow, and the speed was rather slow. A bright streak was left behind, with peculiar luminous dust-like matters about it. These points, together with the apparent track which is pointing backward to the well-known radiant point, are likely to prove the meteor to be belonging to the shower connected with the Winnecke comet. The maximum brightness of the meteor was estimated to be about four times as bright as the full moon so that its stellar magnitude is $-14 \pm 1$.

It was a further surprise to the writer after a few moments' consideration when he realized that this great meteor was in the central part of the heavenly region which he was photographing. The exposure was extended from $23^h\ 33^m$ to $23^h\ 56^m$, and, after developing, the image of the meteor was found quite satisfactory together with the aimed-at asteroids and Saturn on the same plate. A beautiful track of the meteor, its three knots, and the nebular appendages along the track are all clearly shown. The total brightness and the length of the track in the photograph are considerably inferior to the visual impression of the writer, certainly because of the reddish color of the meteor. The duration of the whole apparition was estimated visually to be at least five seconds.

## STELLAFANE.

By RUSSEL W. PORTER,*

When the Springfield Telescope Makers tired of transporting their heavy instruments to the neighboring peaks of the Green Mountains to pass the night through in the open, they acquired a mountain top three miles from the village accessible to cars, and started to build Stellafane. This establishment is now completed, and while it has been given considerable publicity in the press, no adequate description of its equipment has been published.

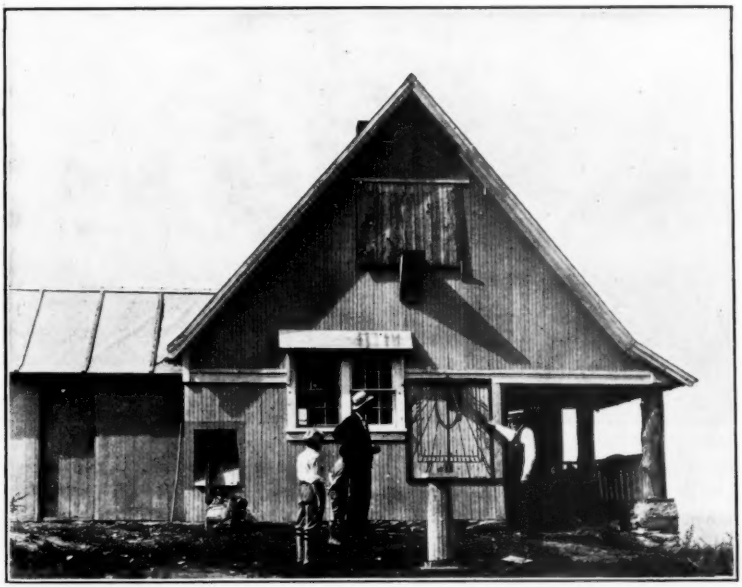


FIGURE 1.

The building, started in the fall of 1923, has grown to meet the expanding needs of our organization. Probably "Astronomical Club House" would describe its function as well as any other expression, for there is a well equipped kitchen at the rear and sleeping accommodations are provided on the second floor. A rather unusual requirement to make a member eligible is that he shall have completed a telescope of his own making. This restriction tends to keep the membership down, though added to steadily from year to year.

*Optical Associate, Jones & Lamson Machine Co.

The living room is comfortably furnished. There is a large fireplace and blackboard, the walls are covered with astronomical photographs and there are alcoves for books. The nucleus of the library contains literature on telescope making and general astronomy, most provided through gifts from the Harvard Observatory, the *Scientific American* and a donation of $100.00 from an amateur enthusiast from Virginia. The work shop, added last fall, contains everything needed for grinding and polishing mirrors, with tools for making temporary alterations or repairs to the mountings. Here also are stored the telescopes.

The building is of wood frame, built everywhere on the ledge and securely anchored to the rock with steel cables.

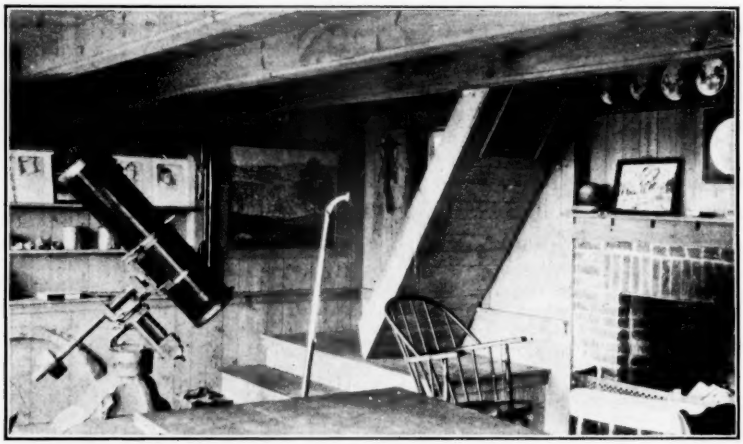


FIGURE 2.

The outlook, north, is superb. The main range of the Green Mountains forms the western horizon. New Hampshire hills bound the east and Ascutney, a peak over 3000 feet high, stands alone directly north. The coördinates of Stellafane, as determined by the Geological Survey which has incorporated the station into its secondary triangulation system, are

Lat. 43° 16′ 41″.30 N
Long. 72 31 10.11 W
Elevation above mean sea level, 1290 feet.

Electric lights were installed this year.

For equipment we have a 16-inch mirror of 75 feet focal length on a pier 70 feet south of the building. Another 16-inch flat mirror placed on the south wall at a second story window sill delivers the sun rays to the paraboloid 70 feet away which in turn converges them into an upper room where the sun's image is thrown on a screen and where it may be studied by a crowd directly.

Just outside the west wall of the living room is a pier supporting the transit instrument. This consists of a revolving horizontal telescope with a 3-inch prism outside its objective with its eyepiece inside the living room. All optical parts are by Brashear.

There is evidently a spirit among our members to get away from hide-bound precedent and try out any old mounting once. One of these attempts at originality is seen protruding from the south wall west of the kitchen window. It is what might be called a polar Cassegrain, comprising a perforated 12-inch mirror of 4 feet focal length mounted in a polar axis of the instrument and a 16-inch flat capable of movement about a declination axis. (It will of course take only stars south of the Zenith.) The optical train is as follows:

The large flat delivers the light to the 12-inch paraboloid. This mirror converges the rays upon a 3-inch hyperboloid which in turn delivers the image to a fixed eyepiece in the room. Settings in declination and right ascension are controlled at the eyepiece, very much like the Gerrish polar telescope at Harvard Observatory. The instrument is nearly completed, all optical parts having been made.

We are also at work on a spectrohelioscope from designs by Dr. George E. Hale. Some of the optical parts and the coelostat are finished and we are only awaiting the necessary grating before carrying the instrument to completion.

Of the many forms of equatorial mountings made by the members, the one in most use at Stellafane is that known as the Springfield type since this particular form was developed here. There are several of these telescopes permanently located on the lawns of members in the village, and many more have been built by amateurs elsewhere. Its distinctive feature lies in its having a fixed eyepiece and being capable of reaching all parts of the heavens. The mounting has been designed with special reference to the limited machining facilities of the average amateur and that will provide him with a rugged, serviceable mounting with both slow and fast motions.

It is timely here to speak of the campaign undertaken by the *Scientific American* to popularize astronomy through providing the tyro with the necessary literature whereby one may make his own instrument at moderate cost and provide him with the sources where the glass abrasives, rouge, pitch, etc., may be obtained. This is the first time in this country that the needed information has been made available. Their little book, "Amateur Telescope Making," is now going into a second and larger edition.

Chiefly through the publicity thus obtained, young America has taken up telescope making with a vengeance. One club in Pasadena, California, has outgrown the parent body here, having a membership of sixty or more members. Other large clubs have sprung up in different parts of the country, notably at Riverside, California, Denver, Colorado, and Detroit, Michigan.

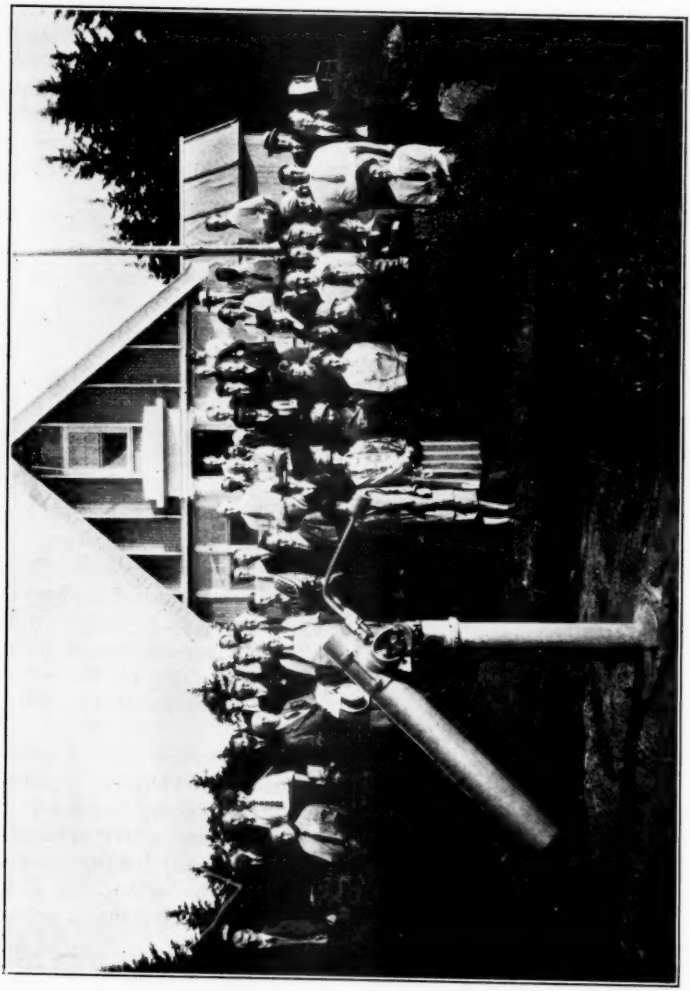


FIGURE 3.

Stellafane has already had two conventions, where enthusiasts (mostly from New England) foregather to compare notes and to find out what each has been doing. It was at one of these meetings, last July, that Mr. Everest described his new method of polishing mirrors on comb foundation instead of upon pitch. In fact our conventions act very much like a clearing house for ideas relating to reflecting telescopes.

Of the photographs accompanying this article, Figure 1 shows the south elevation of Stellafane. The wing at the left is for glass working. At the left center is the polar Cassegrain. Above in the gable is the bracket for supporting a coelstat for the sun telescope. Right of center is a wall sun dial and the wood shed; Figure 2 is the interior of living room at Stellafane. The stairs swing up out of the way when not in use. The walls are covered with sketches of the members, photographs of the moon, notable astronomers and glass workers, etc.; Figure 3 is of the front of the building, showing a group of mirror makers, taken at the second annual convention of the Springfield Telescope Makers at Stellafane, Springfield, Vermont, July 9-10, 1927. These enthusiasts came from states as remote as Michigan and Virginia. One of the Springfield mountings is shown in the foreground. The inscription on the barge board of the gable is the familiar quotation from Psalms referring to "the glory of the heavens."

## THE PHOTOGRAPHIC STUDY OF LONG PERIOD VARIABLE STARS.*

By HARLOW SHAPLEY and W. F. H. WATERFIELD.

Although the Harvard collection of photographs has never been used systematically for the study of long period variable stars, its rich possibilities have been mentioned at earlier meetings of the Association. In the present note we desire to call direct attention to the potential usefulness of the photographic material that has been accumulating at Harvard for the last forty years.

About two hundred thousand plates, distributed through eight or ten series, are available for the study of long period variables. Each series represents the work of a single photographic telescope. Probably the most useful plates are those of the sky patrol, made with telescopes of approximately twelve inches focal length, which has been maintained for about thirty years, so that the sky has been covered several hundred times. The great advantage of the patrol plates is their frequency, and their chief limitation is the magnitude limit. Photographic magnitudes fainter than twelve are, in general, unattainable on the patrol photo-

*Presented at the New Haven meeting of the A.A.V.S.O., May 21, 1927.

graphs made prior to 1923. In that year two Zeiss Tessar lenses were adapted to the patrol work, extending the photographic limit to between the thirteenth and fourteenth magnitudes. For photographic observations between 1885 and 1899 we can, however, make use also of the systematic patrol maintained by two 8-inch lenses—the Draper telescope in the northern hemisphere and the Bache telescope in the southern.

There are four different types of work on long period variables that can be carried out successfully, on extensive systematic plans, at the Harvard Observatory. They deal with (1) discovery, (2) testing of suspected cases, (3) study of period changes for all long period variables brighter than photographic magnitude thirteen at maximum, and (4) the determination of photographic light curves for all long period variables brighter than the photographic magnitude fourteen at minimum. A short discussion of these major problems follows.

1. *Discovery of Variables.* A systematic survey of all stars in the Milky Way to the fifteenth magnitude and in parts fainter, which has been in progress at Harvard for a few years and will probably continue for a few decades, will reveal several hundred, possibly one or two thousand, new long period variable stars. Most of these will be fainter than the eleventh photographic magnitude at maximum, and will therefore be of little direct concern to most of the members of the A.A.V.S.O. who work visually.

The long period variables are but one of the by-products of this general search into the dimensions and structure of the Milky Way. The plates to be used are made with the larger photographic telescopes—the 24-inch Bruce and 10-inch Metcalf telescopes in the southern hemisphere, and the 16-inch Metcalf in the north. At least twenty thousand photographs will be made especially for the program and an equal number of long exposure plates made in past years is also available. Outside the Milky Way zone (thirty degrees wide), which is completely covered, we have included thirty-six regions in higher latitude for the general survey of galactic structure. But no attempt is made to cover the whole sky, partly because the faint stars are highly condensed in the Milky Way, and also because the program is already large and the delays that would arise from long and complete systematic studies of the less interesting higher latitudes would not be justified. High-latitude regions are sufficiently uniform for sampling methods through the usual device of selected areas; low-latitude regions must be treated completely because of the non-uniformity along the Milky Way.

An important feature of the past study of the long period variables at Harvard has been the examination of spectra, which has led to many discoveries. A large number of the new variables recorded by Mrs. Fleming and Miss Cannon were detected by the presence of bright lines of hydrogen, and not at all by observed variation in magnitude. The continuation of the Henry Draper Extension during the next few years

will add to the number of known long period variables. With two or three exceptions every Class M star with bright lines shows more or less typical variation through a large range.

A third potential source for new discoveries at the Harvard Observatory will be exploited during the next year or so through the systematic re-examination in a blink microscope of the brighter stars (112) shown on the current patrol plates. The sky has once been covered in a systematic examination of such photographs, without the service of a blink microscope, but only four or five plates of each region were compared by superposition. We can estimate on a statistical basis that only about one-half of the variable stars brighter than the eleventh magnitude and with a range in excess of four-tenths of a magnitude have been discovered up to the present time. Probably a large number of those yet undetected will be found through the careful blinking of fifteen or twenty good plates on every region over the sky.

For the three following reasons it will be of importance to find as many long period variable stars as possible.

a. There is a probability of finding additional abnormal types of variability, which may help to establish affiliations of the long period variables with other classes of variable stars, and contribute to an understanding of the cause of the variation. In problems of evolution the abnormalities are always more important than typical cases.

b. The attainment of a complete survey will strengthen the statistical discussions of the relative numbers of different classes of variables. Improved data on the relative frequency of the subtypes of light curves for the long period class will also become available.

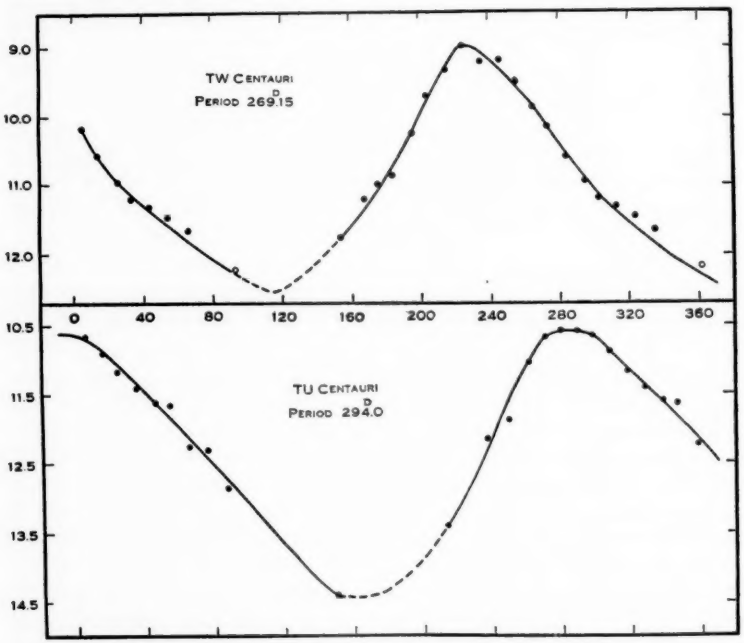
c. The determination of the distances of the long period variable stars in the Milky Way clouds (and therefore of the clouds themselves) will become possible. For long period variables, as well as for Cepheids and eclipsing stars, we are now able to estimate the distances, once the apparent magnitudes and periods have been determined. The long period variables therefore become an important factor in our measuring of the Milky Way, and the more we discover and study, the firmer will be our knowledge of the general galactic system.

These matters of peculiar types, of statistical completeness, and of distances appear to justify a considerable effort in the discovering of long period variable stars with the use of the present and future photographs at the Harvard Observatory.

2. *Suspected Variables.* There are more than four hundred variable stars which almost certainly belong to the long period class, but for which no periods have yet been determined. We place these stars tentatively in the long period list on the basis of large ranges, of Class M spectra, or of preliminary observations which indicate long periods without giving actual values.

Of the suspected long period variables about 150 become brighter than the eleventh magnitude, and about 260 are between the eleventh and fourteenth magnitudes, at maximum. These numbers cannot be taken too seriously because of the somewhat chaotic standards of magnitudes employed in the various lists.

The work at the Harvard Observatory shows that probably for most of the suspected objects brighter than the eleventh magnitude we shall be able to determine the periods, and with the help of plates made with the 8-inch telescopes we shall be able at the same time to determine many photographic light curves. Probably for one-half or more of the variables between the eleventh and fourteenth magnitude at maximum we shall in the course of a few years be able to verify the classification and determine the period.




As an illustration of the systematic work that can be done on the suspected long period variable stars, the accompanying diagram represents the light curves of TU Centauri and TW Centauri, for which the periods have been found to be 294.0 and 269.15 days, respectively, and for which the photographic magnitude ranges are 10.6 to 14.5, and 9.0 to 12.5. For TW Centauri 255 definite estimates could be made, ninety-five per cent of which were on photographs made in the sky patrol. For TU Centauri 181 definite observations could be made, about seventy per

cent of which were on the small scale photographs. In each case some four or five hundred plates were examined, on many of which the stars were too faint for satisfactory estimates.

For the study of these two stars, which have yielded not only light curves but also accurate determinations of the periods, the actual time taken was three days each. A longer time would be needed if a careful search were made through all the series of plates of larger scale, a procedure that might be necessary for fifty per cent of the suspected long period variables brighter than the eleventh magnitude at maximum.

3. *Changes of Period.* There are at the present time about eight hundred variable stars of the long period class for which the light elements are known. About fifty of these may be considered doubtful, either because of small range or insufficient observations. Of the eight hundred stars, 460 are now on the lists of the A.A.V.S.O. There remain some three hundred variable stars of known period which are not under systematic observation. Many of them are too faint for general study, either photographically or visually, but many others are within the range of the Harvard photographs, at least at maxima, and accordingly they can be investigated systematically for changes of period.

One of the most important parts of the A.A.V.S.O. program is this problem of irregularities in the periods of the long period variables. The usefulness of the Harvard plates has already been shown for several stars for which the irregularities of period have been investigated and published in the Harvard Bulletins by Mr. Campbell, who has made use of the photographic observations given in the Observatory publications that deal with long period variable stars.[1]

4. *Photographic Light Curves.* The Harvard plates will provide very good mean photographic light curves for all long period variable stars brighter than the fourteenth photographic magnitude at minimum. Too little is known of the colors of the long period variables to say definitely how many light curves are derivable from such a survey, but the number is probably two or three hundred. We believe it is important to obtain photographic light curves, on well established magnitude systems, in order to compare directly with the light curves that have been accurately determined by the visual observers. It is through these comparisons that we shall obtain the knowledge now lacking of variations in color with brightness for long period variable stars. The comparisons will also help in the classification of the light curves, which Mr. Campbell frequently finds to differ when photographic and visual observations are compared.[2]

[1] Harvard Annals, **47**, part 1, A Photographic Study of Variable Star Sequences; part 2, Photographic Magnitudes of 107 Variable Stars of Long Period. H.A., **80**, No. 8, Light Curve of T Andromedae. H.A., **84**, No. 4, Discussion of Thirteen Circumpolar Variables. H.C. 270, The Long Period Variable W Hydrae.

[2] See various Harvard Bulletins published in 1926 and 1927.

The determination of accurate photographic light curves depends to a large extent on previous exacting work on standard sequences, followed by careful work on the photographic variations of the variable star itself. To carry out this part of the program systematically will require several workers for a number of years.

## LUNAR ECLIPSE OF JUNE 15, 1927.

By G. H. HAMILTON.

The eclipse of the moon of June 15, though mentioned as a total one in the *Nautical Almanac*, could, I believe, hardly have been considered such. Of course I realize the total phase was really only grazing, but, even so, from the observations and photographs I obtained here in Mandeville there never was what might be considered a complete dimming of the disk.

THE MOON PARTIALLY ECLIPSED.

The accompanying photograph, taken at $7^h\ 14^m$ G.C.T., gives a fair idea of the relative intensities of the umbra and penumbra and shows their woolly line of demarcation. This last was very visible to the naked eye and showed as an intense coppery red band. A small pocket telescope of 9/16-inch aperture and magnification of about four diameters showed it even better, but the 12-inch reflector of 9 feet 10 inches focal length, with which the photograph was taken, visually diffused this appearance to such an extent and showed so much detail over the *whole* surface of the moon that, with a power of 120, the phenomenon was virtually non-existent—no definite dividing line was about all one could say of it.

I took altogether four photographs of different stages of the eclipse before totality and managed to get one during the time the total eclipse was supposedly on. Throughout, the surface within the umbra remained virtually unrecorded—due to short exposures, since the instrument has, as yet, no clock, and the fact that the plates were not sensitized for red—though in the first exposure the negative shows more than a suspicion of the eclipsed disk. My photograph of the total or supposedly total phase gives, on the negative, quite an arc around the limb, the place where I believe the disk was not quite covered by the umbra. I could not get a positive of this negative good enough to be reproduced.

My times of "totality" were quite uncertain. I was expecting complete immersion every second, while in reality a bright spot (the final portion of the un-eclipsed moon) travelled around the limb and finally gradually increased as the eclipse passed off. It is this bright arc which I find registered on my plate taken at the computed time of totality.

If I had thought, I would have taken position circle tangents of this illuminated arc, as it travelled over the limb, but I was too interested in trying to study any variation in detail that might occur on the eclipsed portion of the surface due to sudden cooling. I was unable to detect any such—but the seeing during the eclipse was not of the best though the atmosphere for the whole time was extremely clear.

THE HAMILTON OBSERVATORY,
MANDEVILLE, JAMAICA, JUNE 27, 1927.

## PROJECTS FOR METEOR PHOTOGRAPHY.*

By WILLARD J. FISHER.

Since a grant from the Milton Fund of Harvard University has been made for the purpose "to test and develop apparatus for the photography of meteors," and as there has been some discussion of meteor photography as a side issue of variable star observing, a statement is made of the reasons for the grant and of certain probable lines of investigation.

Certain periodically returning meteor swarms, the Leonids, Perseids, Andromedes, and others, are known to be van-guards or rear-guards of periodic comets; this fact was one of the outstanding astronomical discoveries of the Nineteenth Century. But careful investigation, especially by Schiaparelli, von Niessl, and Hoffmeister, shows that most meteorites and a great many fireballs cannot be related to comets in any way; on the contrary, they are, quite likely, even certainly, mere transient visitors from interstellar space, moving with hyperbolic velocities from infinity to infinity, except as the accident of collision with

*Paper read at the New Haven meeting of the A.A.V.S.O., May 21, 1927.

the earth's atmosphere at once destroys them and makes them known. These not being related to the solar system, the interesting discovery has been made that in some groups of cases the incoming branches of hyperbolic orbits arise from definite small areas of the celestial sphere, asymptotic radiants, so to speak; as if there were cosmic streams of meteors sweeping through space in definite directions. Thus, in an article published in 1890, von Niessl adduces two such radiants. One, from six fireballs observed at various dates in April, May, and September, 1865-1878, is centered at $\lambda = 182°$, $\beta = +4°$, with spread in $\lambda$ 9°, in $\beta$ 4°.6. Another, from five fireballs and one meteorite fall, dated in January, May, June, November, and December, 1862-1890, is centered at $\lambda = 83°$, $\beta = +1°.7$, with spread in $\lambda$ 6°, $\beta$ 5°.5.

Almost all meteor observing heretofore has been visual. This gave the moment of apparition quite accurately; by immediate plotting on a gnomonic chart the celestial plane of a meteor path was got fairly well, the positions of beginning and ending, less well. The duration of flight had generally to be estimated without instrumental help, and was not very reliable, even for experienced observers. Corresponding simultaneous observations at sufficiently separated places gave the means of computing the apparent radiant, the beginning and ending heights, the length of air-path and the mean velocity in the air. The last was not very accurate, for it could not be any better than the estimate of duration. Yet, for the determination of the path in space the velocity has to be accurately known.

Photography cannot supersede visual observation in the study of meteors. But it can and does yield data of high precision. The problems of stationary radiants, changes in brightness during flight, exact paths and speeds, deceleration in the air-path, and the spectral evidence of the physical nature of the process, with all their implications as to the nature of the atmosphere and the cosmic relations of the meteors themselves, can be dealt with exactly only by photography. For example, the only known determination of the changes in speed of a shooting star during the few seconds of its flight was made photographically many years ago at the Yale Observatory.

The photographic data now in existence make up a considerable amount. On the plates of the Harvard Observatory there are known to be more than 323 meteor trails. Barnard found several score on his Milky Way and other plates. There are many at the Heidelberg Observatory. Wherever astronomical photographs are frequently taken some meteors are bound to be caught in flight. But these meteor trails are taken incidentally in the course of astrophysical programs, the moments of apparitions are uncertain, frequently by as much as an hour, they provide no clue as to velocity, and they are not made at more than one station, at the ends of a base line. They are simply records of the phenomena, accurate and highly instructive, but incomplete.

An attempt is now planned to stimulate the production of suitable

lenses, to develop suitable cameras, to plan apparatus for determining the time of apparition without the intervention of a watcher, and for the measurement of several successive velocities along any meteor path of several degrees length. None of these projects should be regarded as impossible, though the suitable lens is admittedly not a simple matter.

Given these instrumental aids, the only other desideratum for the solution of the problems of meteoric physics and meteoric astronomy is, plenty of meteors.

## THE TEACHING OF ASTRONOMY.

**(Second Paper)**

**By S. L. BOOTHROYD.**

Astronomy is perhaps the ideal science to give instruction and inspiration for all who do not contemplate a scientific career. It is at the same time that science which most ideally serves as the fitting and complete introduction to every phase of scientific training.

It is, in my judgment, very unfortunate that elementary descriptive astronomy has been almost totally eliminated from the curriculum of nearly every High School to make way for supposedly more practical subjects.

The foundation of a great structure is generally entirely hidden and its existence is unknown to the superficial observer or even to the superficially curious. It would be as fitting for the engineer, considering only the evidently useful and beautiful superstructure, to ignore the foundation, as for the educator to argue that those basic subjects, which are not always directly used in whatever ultimate special training a given individual may obtain, should therefore be eliminated from the curriculum of school or college. Just as the foundation of a great structure is indispensable for the stability and permanence of a useful and a beautiful building, so fundamental training, in all that goes to produce strong bodies and fine character, is the foundation on which an enduringly useful and spiritually satisfying education is to be built.

We no doubt can build this foundation in a great many different ways and our method as well as the foreign material used in building it, will vary in each individual case. However, in each case the easiest and simplest method which accomplishes the result is the best. The foundation having been well and firmly laid, the training for specialized work is a comparatively simple problem.

One of the foremost of the constructive thinkers of the ages has said, "Education is the instruction of the intellect in the laws of nature, under which I include not merely things and their forces, but men and their ways; and the fashioning of the affections and the will into an earnest and loving desire to move in harmony with those laws." This

is perhaps the most comprehensive statement of what fundamentally constitutes an education, that has ever been made. With such an education as a foundation, one is ready to be trained for the special work in which, by nature, he can render the best service to the world,—a service which will bring satisfaction to himself, as well as glory to the age in which he lives.

Granting that Huxley's is as comprehensive a definition of education as can be formulated, we cannot but be impressed with the large place which science and its history should occupy in our scheme of education. Let us proceed to see how the teaching of Astronomy may contribute to the attainment of such an exalted ideal of education.

Curiosity about the mysteries which surround us will lead practically every normal person to wonder about them. Who has not looked into the sky on a clear, moonless night and been silenced into wondering awe? This innate curiosity is our starting point in the teaching of science and the wise teacher will turn this wonder into serious questioning and thus intensify it into the spark which will quicken into action every other faculty which leads to the development of noble character. We might liken curiosity, thus quickened into action, to the intensified spark in a gas engine, the spark which fires the latent energy of the intellect and sustains the will in holding us to the task of finding the solution to the questions which present themselves on every hand.

The beauty of astronomical phenomena, the regular recurrence of those few which insistently call our attention to them, makes astronomical study the natural introduction to organized scientific inquiry. All who take any notice of external events have noted such evident phenomena as the succession of day and night, the changing phases of the moon, the succession of the seasons, with the concomitant change in the relative length of the day and night and the changes in the direction of the place of the rising and setting sun and its varying altitude at noon. Such commonplace phenomena as these should be the starting point for astronomical study and this should begin in early childhood, as perhaps a part of nature study. The next step should lead the student to make careful and systematic observations, for example: to observe where the sun rises and sets, learn to recognize the conspicuous star groups and note the stars that set as soon as it is dark, for each month of the year, determine the length of the shadow cast by a vertical post at noon; determine the time interval from sunrise to sunset for a period of a year at least. The student will almost inevitably be led, through his curiosity, to other questions, such as: Is the moon day the same length as the sun day? Is the star day the same length as the sun day? and many other questions which will stimulate his interest in observing. If he is not naturally so led to inquire, the wise teacher will lead him by natural steps to such questions as require only careful, systematic observations to answer.

In some such manner our student is being trained in careful and

accurate observation. When he gets his own answers to these questions, his wonder and curiosity will be still further aroused and he is easily stimulated to extend his observations and to increase their accuracy. He may also be led to look for less evident phenomena. Almost at the very outset these first steps in science teaching will lead to another. Our student will inevitably be interested to observe many phenomena of the same general kind, in order to see if the seemingly obvious explanation of the first will explain all phenomena which are judged to be of the same class.

Suppose our young observer has discovered that the sun day, the moon day, and the star day are all different, encourage him to observe a number of stars and see if all star days are the same. He will almost certainly observe one or more planets, thinking they are stars. He will thus be led to make the second important step in the scientific method, namely classification of observed phenomena. All people classify things from the time they observe at all but at this point our inquirer is faced with the fact that there are other bases of classification than those which are so obvious that even the most casual observation will disclose a distinction. It may also serve to bring home to him the further fact that a number of observations of the same object may be necessary to the discovery of its unlikeness to other objects which appear the same. At this point the use of a telescope may be desirable in order to bring out other differences between stars and planets.

When our young investigator has gone thus far, and perhaps earlier, he has been curious to know why some bodies, namely: sun, moon, and planets, wander among the stars. At this point, wise suggestion may help our student to use his own imagination and invent hypotheses and to try them out to see if they explain the observed phenomena. This is perhaps the most difficult step in teaching science and at this point the science of astronomy exhibits its superiority over other sciences as a means of teaching this important step in the scientific method. After our student has discovered the earliest known distinction between stars and planets and that all star days are the same, he will at once see that he has four classes of days to explain. Here is a very limited number of kinds of facts to explain and a problem of the simplest kind. In no other science do we find so simple a problem at the outset. The question arises: How shall we lead our student to make the next step and try to discover a unifying principle which explains this limited array of facts? Shall we leave our student to flounder and use his own imagination as best he may to suggest an explanation and then aid him to use his reason to test the suggested explanation, or shall we give him some wisely selected historical reading that he may know how early man attempted to answer this question and how, after many faltering steps, a satisfactory answer has been found? Would it be wiser yet to simply give the accepted explanation as soon as the question of the cause arises? The latter is the usual method, or we do even worse, we tell the

student all the facts and then give the accepted explanation. If we do this, we are instructing rather than teaching. If our education were properly co-ordinated, we should use a combination of the first two methods suggested by our question. If our educational system were what it should be, a large part of the time in the early grades would be devoted to directing the normal activities of children towards discovering the simpler facts of nature for themselves and their more formal studies would be so related to such nature study as to make the more formal a natural part of the normal, healthful activity of the developing mind. In the illustration already used our student would naturally be led to geometrical study in the attempt to test the various ideas which would suggest themselves as possible explanations of the different lengths of sun day, moon day, and star day. This will naturally lead to another object in science teaching, namely: to bring home the necessity of testing the deductions made from our hypothesis by further observation.

The great advantage which astronomy possesses as a means of teaching all the five steps in the scientific process is that the phenomena to be observed are universal and are few enough in number so that the beginner, even though a child, is not confused and bewildered. Furthermore, the element of wonder is never lacking. The beginner soon discerns law and order in astronomical phenomena. The wise teacher will find numerous opportunities to extend the idea of orderliness naturally engendered by the experiences met in observing and contemplating celestial phenomena, to the moral and spiritual realm and thus "to fashion the affections and the will into an earnest and loving desire to move in harmony with the laws of nature."

Such a program of teaching astronomy as a part of a unified plan of nature study, carried out all through the grades and High School, would lay the foundation for more specialized training in the sciences in College and University. It would also have the advantage that students in the High School would, through their study of nature, leading logically to early training in the use of the scientific method, become interested in studying history to see how mankind has solved the very problems which he, himself had met. This would naturally lead to a normal human interest in elementary mathematics. He might, for instance, become interested in the geometrical schemes suggested by Pythagoras, Eudoxus, Hipparchus, Copernicus, and Kepler to explain the apparent motions of the sun, moon, stars, and planets. Through historical reading, interest in the human problem caused by the constant conflict between ancient authority and that spirit of adventure in man, which insistently beckons him to explore the unknown, would be engendered. This would interest our student in Galileo and his discoveries and the dawning realization of the fact that the unfolding mystery of the heavens requires not only geometrical interpretation but that the movements and other phenomena are to be explained as due to physical

causes. This would at once be a powerful stimulus to deepened interest in physics and chemistry.

Thus should our college course give a well-rounded education in the physical sciences and in their history which should be the firm foundation on which a highly specialized education in any little part of these sciences could be safely reared.

I have tried briefly to show that astronomy is the cornerstone for such foundation in the physical sciences. It was so historically and I am firmly convinced that it is still the shortest and surest road to building such a firm foundation for a scientific career.

Even though we cannot presuppose such ideal elementary training in science, yet it is still possible in an introductory course in astronomy to follow quite fully the plan here outlined, provided the course is not an intensive course, all crowded into a half year or less. Such an introduction to astronomy and through it to physical sciences will be far more useful if given in the freshman year. This is especially true for those students who look forward to a scientific career. It also applies to those who anticipate a literary career, for what can the frequent references to astronomical lore in all literature mean to those who are almost totally ignorant of the most elemental facts in the science, or of its history.

Such an introduction to astronomy as has been suggested is then the foundation for a scientific education as well as stimulating and broadening to all and especially to those who look forward to a literary career.

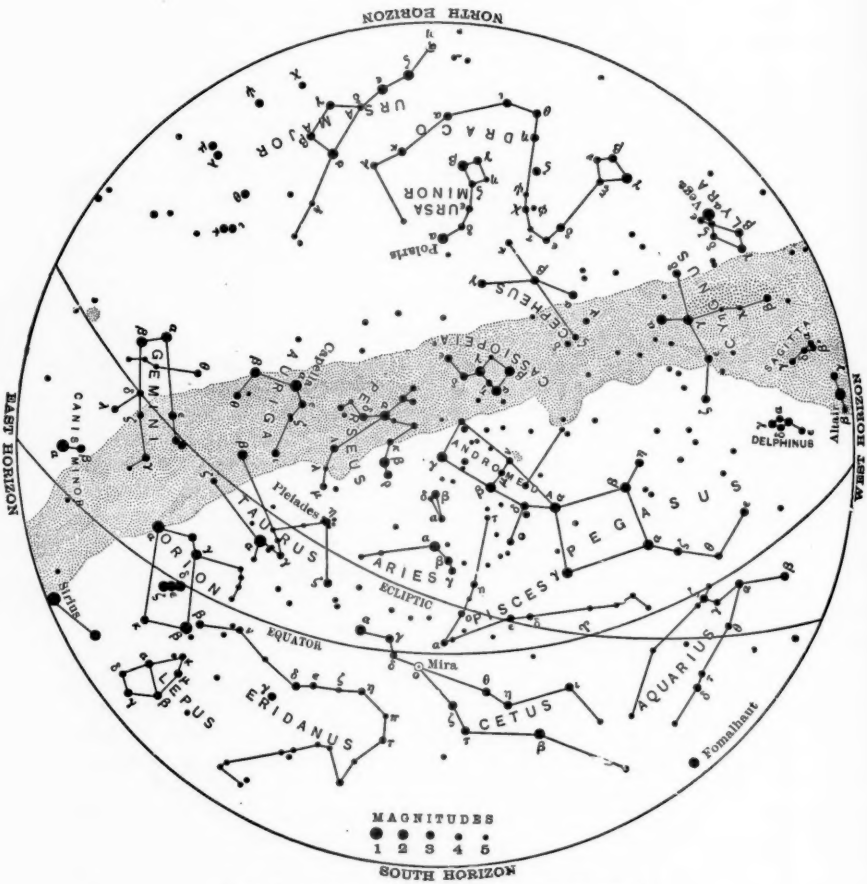
For the physical science group a more comprehensive senior course, giving the results of the latest research, is also the capstone of the arch of scientific education. It gives a review and application of most of the fundamental principles of the physical sciences, correlating them and giving a clear conception of the unity of nature and the sublimity of the universe. It is like standing on the highest mountain top at the end of a strenuous journey through the foothills and into the mountains, from which we can look back and get the relation of the country through which we have traveled to the whole vast surroundings of our path, and from which we may look forward to the far vistas and glories ahead. We climbed a small eminence at the beginning of our journey, in the introductory course, from which to outline our trail ahead. How fitting that at the end we should climb the highest peak of all the range to get a proper sense of proportion and thus enable us to wisely direct our onward course.

Such an introduction and such a final ending should lay the necessary foundation in the elements of all the sciences. It should help us to realize the marvellous miracles which surround the commonest day, miracles which await only the seeing eye, the ear sensitive to the music of the universe, and the mind awake to receive the impulses of the vibrant life of the infinite.

CORNELL UNIVERSITY, ITHACA, N. Y.

## PLANET NOTES FOR DECEMBER.

By CLIFFORD E. SMITH.




THE CONSTELLATIONS AT 9:00 P.M. DECEMBER 1.

The *Sun* during December will be moving southeast until the occurrence of the winter solstice on December 22. After this date it will be moving northeast. The occurrence of the winter solstice marks the beginning of winter. At the beginning of December the sun will be in the northeast part of Scorpio. During the month it will cross the southern part of Ophiuchus and move into the southern part of Sagittarius. On December 24 there will be a partial eclipse of the sun which will be invisible at Washington. The positions of the sun on December 1

and December 31 will be respectively, R.A. $16^h\,24^m$, Decl. $-21°\,37'$; and R.A. $18^h\,36^m$, Decl. $-23°\,11'$.

The phases of the *Moon* will occur as follows:

| | | | | |
|---|---|---|---|---|
| First Quarter | Dec. | 1 | at 8 P.M. | C.S.T. |
| Full Moon | | 8 | " 12 M. | " |
| Last Quarter | | 15 | " 6 P.M. | " |
| New Moon | | 23 | " 10 P.M. | " |

The moon will be at perigee (nearest the earth) on December 7, and at apogee (farthest from the earth) on December 18.

*Mercury*, at the beginning of the month will be in the central part of Libra about an hour and fifteen minutes west of the sun. Thus it will rise about an hour and fifteen minutes before the sun. At the end of the month it will have crossed into Sagittarius and will be near conjunction with the sun. On December 9, Mercury will be in conjunction with Mars and on December 17 it will be in conjunction with Saturn. Mercury will be at aphelion on December 28.

*Venus* during December will be a brilliant morning star rising about three hours before the sun. First it will be about five degrees north of Spica ($\alpha$ Virginis) in Virgo. By the end of the month it will have crossed into Libra near $\gamma$ Librae. Perihelion will occur on December 9.

*Mars* will be near the sun. During this time Mars will move from the southern part of Libra to the boundary between Ophiuchus and Scorpio. Mars will be in conjunction with Mercury on December 9 and with Saturn December 26.

*Jupiter* will be an evening star and will be in Pisces near the border of Aquarius. Since it will be in quadrature east of the sun on December 17 Jupiter will be near the meridian at sunset during this period.

*Saturn* will be in Scorpio near the sun. Conjunction with the sun will occur on December 3. As has been mentioned Saturn will be in conjunction with Mercury on December 17.

*Uranus* will be in Pisces about four degrees west of Jupiter. Uranus will be in quadrature east of the sun on December 22.

*Neptune* will be a morning object in Leo just east of Regulus ($\alpha$ Leonis). It will be near the meridian at sunrise.

## Occultations Visible at Washington.

[From the *American Ephemeris*.]

| Date 1927 | | Star's Name | Magnitude | IMMERSION. Washington C.T. | IMMERSION. Angle from N | EMERSION. Washington C.T. | EMERSION. Angle from N | Duration |
|---|---|---|---|---|---|---|---|---|
| | | | | h m | ° | h m | ° | h m |
| Dec. 1 | 69 | Aquarii | 5.6 | 17 41 | 66 | 19 1 | 230 | 1 20 |
| 1 | $\tau$ | Aquarii | 4.2 | 19 19 | 34 | 20 29 | 260 | 1 10 |
| 4 | 117 | G. Piscium | 6.5 | 18 14 | 57 | 19 27 | 232 | 1 12 |
| 5 | $\nu$ | Piscium | 4.7 | 2 54 | 101 | 3 37 | 216 | 0 44 |
| 5 | 25 | Arietis | 6.5 | 21 43 | 111 | 22 29 | 185 | 0 46 |
| 9 | 52 | B.Geminorum | 6.5 | 23 31 | 90 | 0 51 | 258 | 1 20 |
| 10 | 176 | B.Geminorum | 6.3 | 22 51 | 27 | 23 26 | 329 | 0 35 |
| 10 | 181 | B.Geminorum | 6.0 | 23 2 | 68 | 0 13 | 290 | 1 10 |
| 14 | 46 | Leonis | 5.8 | 4 2 | 174 | 4 51 | 244 | 0 49 |
| 27 | $\kappa$ | Capricorni | 4.8 | 19 38 | 352 | 19 57 | 317 | 0 19 |
| 29 | 336 | B. Aquarii | 6.3 | 19 57 | 3 | 20 37 | 292 | 0 40 |

## Phenomena of Jupiter's Satellites.

VISIBLE AT WASHINGTON.

[From the *American Ephemeris.*]

CENTRAL STANDARD TIME, MIDNIGHT = $0^h$

| 1927 | h | m | | | 1927 | h | m | | |
|---|---|---|---|---|---|---|---|---|---|
| Dec. 0 | 18 | 47 | III | Sh. I. | Dec. 13 | 22 | 18 | II | Oc. R. |
| | 21 | 27 | III | Sh. E. | | 22 | 25.6 | II | Ec. D. |
| | 22 | 6 | I | Tr. I. | 14 | 21 | 16 | III | Tr. I. |
| | 23 | 23 | I | Sh. I. | 15 | 17 | 26 | II | Tr. E. |
| 1 | 19 | 26 | I | Oc. D. | | 17 | 32 | II | Sh. I. |
| | 22 | 57.9 | I | Ec. R. | | 20 | 3 | II | Sh. E. |
| 2 | 16 | 34 | I | Tr. I. | 16 | 20 | 23 | I | Tr. I. |
| | 17 | 52 | I | Sh. I. | | 21 | 44 | I | Sh. I. |
| | 18 | 48 | I | Tr. E. | 17 | 17 | 43 | I | Oc. D. |
| | 20 | 5 | I | Sh. E. | | 21 | 17.8 | I | Ec. R. |
| 3 | 17 | 26.8 | I | Ec. R. | 18 | 17 | 0.9 | III | Ec. D. |
| 4 | 22 | 56 | II | Tr. I. | | 17 | 6 | I | Tr. E. |
| 6 | 17 | 3 | II | Oc. D. | | 18 | 25 | I | Sh. E. |
| | 19 | 43 | II | Oc. R. | | 19 | 39.9 | III | Ec. R. |
| | 19 | 47.2 | II | Ec. D. | 20 | 22 | 17 | II | Oc. D. |
| | 22 | 20.8 | II | Ec. R. | 22 | 17 | 26 | II | Tr. I. |
| 7 | 17 | 12 | IV | Oc. D. | | 20 | 3 | II | Tr. E. |
| | 17 | 18 | III | Tr. I. | | 20 | 9 | II | Sh. I. |
| | 19 | 43 | IV | Oc. R. | 24 | 16 | 56.5 | II | Ec. R. |
| | 20 | 12 | III | Tr. E. | | 19 | 39 | I | Oc. D. |
| | 22 | 50 | III | Sh. I. | 25 | 16 | 49 | I | Tr. I. |
| 8 | 17 | 26 | II | Sh. E. | | 18 | 9 | I | Sh. I. |
| | 21 | 19 | I | Oc. D. | | 18 | 27 | III | Oc. R. |
| 9 | 18 | 28 | I | Tr. I. | | 19 | 3 | I | Tr. E. |
| | 19 | 48 | I | Sh. I. | | 20 | 21 | I | Sh. E. |
| | 20 | 42 | I | Tr. E. | | 21 | 3.4 | III | Ec. D. |
| | 22 | 1 | I | Sh. E. | 26 | 17 | 42.2 | I | Ec. R. |
| 10 | 19 | 22.3 | I | Ec. R. | 29 | 20 | 6 | II | Tr. I. |
| 11 | 16 | 30 | I | Sh. E. | 31 | 16 | 58 | II | Oc. R. |
| 13 | 19 | 39 | II | Oc. D. | | 17 | 2.6 | II | Ec. D. |

NOTES—I. denotes ingress; E., egress; D., disappearance; R., reappearance; Ec., eclipse; Oc., occultation; Tr., transit of the satellite; Sh., transit of the shadow.

---

**Occultation of a Seventh Magnitude Star by Jupiter.**—Attention has been drawn to the forthcoming occultation of B.D.—3°5697 by Jupiter on December 7 in *A.N.* 5412 by Monsieur E. Boucher, of Algiers Observatory and in the *British Astronomical Association Handbook for 1927* by the writer. The particulars here given for North American stations have been extracted from the latter publication.

The star, which is of the 7th magnitude, has been well observed on the meridian, and the rigorous combination of the observations of 24 catalogues, and two observations kindly communicated by H. M. Astronomer at the Cape, after reduction to the Boss system, yields

| | R.A. | $\mu\alpha$ | Dec. | $\mu\delta$ |
|---|---|---|---|---|
| 1900 | $23^h\,39^m\,24^s.51$ | $-0^s.0007$ | —3° 43′ 47″.7 | —0″.006 |
| 1927 Dec. 8.0 | 23 40 49.67 | | —3 34 36.2 | |

The immersion is visible over the eastern and central states of North America, while the emersion is visible over the whole of North America. There is a defect of illumination of about 0″.3 at the points of disappearance.

| Place | Observatory | Immersion G.M.T. $7^d\ 23^h$ m | Immersion P.A. ° | Immersion Altitude ° | Emersion G.M.T. $8^d\ 3^h$ m | Emersion P.A. ° | Emersion Altitude ° |
|---|---|---|---|---|---|---|---|
| Mandeville | Pickering | 16 | 86 | 66 | 25 | 218 | 32 |
| Cambridge | Harvard | 14 | 84 | 44 | 28 | 220 | 18 |
| Middletown | Van Vleck | 14 | 83 | 45 | 28 | 220 | 19 |
| Philadelphia | Flower | 13 | 83 | 46 | 28 | 220 | 22 |
| Washington | U.S. Naval | 13 | 83 | 47 | 28 | 220 | 23 |
| Charlottesville | McCormick | 12 | 83 | 47 | 28 | 220 | 25 |
| Ottawa | Dominion | 14 | 83 | 41 | 28 | 220 | 20 |
| Ann Arbor | Detroit | 13 | 83 | 42 | 27 | 220 | 26 |
| Evanston | Dearborn | 11 | 83 | 41 | 27 | 220 | 29 |
| Williams Bay | Yerkes | 11 | 83 | 40 | 27 | 220 | 29 |
| Madison | Washburn | 11 | 82 | 40 | 27 | 220 | 29 |
| Northfield | Goodsell | 11 | 82 | 37 | 27 | 221 | 30 |
| Tacubaya | National | | | | 24 | 219 | 51 |
| Denver | Chamberlin | | | | 26 | 221 | 40 |
| Flagstaff | Lowell | | | | 25 | 220 | 47 |
| Mt. Wilson | | | | | 24 | 220 | 50 |
| Mt. Hamilton | Lick | | | | 24 | 221 | 48 |
| Victoria | Dominion | | | | 25 | 222 | 37 |

No correction has been applied to the tabular positions of Jupiter, so that the times may possibly be as much as $10^m$ in error, on account of the slow movement of Jupiter. At stations where both phases are visible, the observed correction to the time of immersion should be applied to the predicted time of emersion.

Satellite III will be near the star at the time of immersion. It passes in front of the planet at $7^d\ 23^h\ 18^m$, in P.A. 99°. An occultation by the satellite is not possible.

L. J. Comrie.

## VARIABLE STARS.

### Maxima of Variable Stars of Short Period.

**[Calculated by members of the classes in Astronomy at Carleton College.]**

**Given to the nearest hour in Greenwich civil time; to obtain Eastern Standard time subtract $5^h$; Central Standard time $6^h$, etc.**

| Star | R.A. 1900 h m | Decl. 1900 ° ′ | Magnitude | Approx. Period d h | Greenwich civil times of maxima in 1927 December d h | d h | d h | d h | d h |
|---|---|---|---|---|---|---|---|---|---|
| SX Cassiop. | 0 05.5 | +54 20 | 8.6— 9.2 | 36 13.7 | | | 11 13 | | |
| SY Cassiop. | 0 09.8 | +57 52 | 9.3— 9.9 | 4 01.7 | 8 15 | | 16 18 | 24 21 | |
| RR Ceti | 1 27.0 | + 0 50 | 8.3— 9.0 | 0 13.3 | 4 23 | | 12 17 | 20 11 | 28 4 |
| RW Cassiop. | 1 30.7 | +57 15 | 8.9—11.0 | 14 19.2 | 2 20 | | | 17 15 | |
| V Arietis | 2 09.6 | +11 46 | 8.3— 9.0 | 0 23.8 | 5 23 | | 13 21 | 21 20 | 29 18 |
| SU Cassiop. | 2 43.0 | +68 28 | 6.5— 7.0 | 1 22.8 | 3 4 | | 10 23 | 18 18 | 26 14 |
| RW Camelop. | 3 46.2 | +58 21 | 8.2— 9.4 | 16 00.0 | 7 9 | | | 23 19 | |
| SX Persei | 4 10.2 | +41 27 | 10.4—11.2 | 4 07.0 | 1 7 | | 9 21 | 18 11 | 27 1 |
| SV Persei | 42.8 | +42 07 | 8.8— 9.6 | 11 03.1 | 5 16 | | 16 19 | 27 22 | |
| RX Aurigæ | 4 54.5 | +39 49 | 7.2— 8.1 | 11 15.0 | 7 2 | | 18 17 | 30 7 | |
| SX Aurigæ | 5 04.6 | +42 02 | 8.0— 8.7 | 1 12.8 | 7 4 | | 14 20 | 22 12 | 30 4 |
| SY Aurigæ | 05.5 | +42 41 | 8.4— 9.5 | 10 03.3 | 9 0 | | 19 3 | 29 6 | |
| Y Aurigæ | 21.5 | +42 21 | 8.6— 9.6 | 3 20.6 | 1 5 | | 8 23 | 16 16 | 24 9 |
| RZ Gemin. | 5 56.6 | +22 15 | 9.1—10.0 | 5 12.7 | 5 2 | | 10 14 | 21 16 | 27 5 |
| RS Orionis | 6 16.5 | +14 44 | 8.2— 8.9 | 7 13.6 | 6 5 | | 13 18 | 21 8 | 28 22 |
| T Monoc. | 19.8 | + 7 08 | 5.7— 6.8 | 27 00.3 | 4 14 | | | | 31 14 |
| RT Aurigæ | 23.0 | +30 33 | 5.1— 6.0 | 3 17.5 | 4 3 | | 11 14 | 19 1 | 26 12 |
| W Gemin. | 29.2 | +15 24 | 6.7— 7.5 | 7 22.0 | 5 1 | | 12 23 | 20 21 | 28 19 |
| ξ Gemin. | 6 58.2 | +20 43 | 3.7— 4.3 | 10 03.7 | 4 19 | | 14 23 | 25 3 | |

**Maxima of Variable Stars of Short Period—Continued.**

| Star | R.A. 1900 | Decl. 1900 | Magnitude | Approx. Period | Greenwich civil times of maxima in 1927 December | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | h m | ° ′ | | d h | d h | d h | d h | d h | d h | d h | d h | d h |
| RU Camelop. | 7 10.9 | +69 51 | 8.5— 9.8 | 22 06.5 | | | | | 21 20 | | | |
| RR Gemin. | 7 15.2 | +31 04 | 10.0—11.5 | 0 09.5 | 7 10 | 15 9 | 23 7 | 31 6 | | | | |
| V Carinæ | 8 26.7 | —59 47 | 7.4— 8.1 | 6 16.7 | 2 5 | 8 22 | 22 7 | 29 0 | | | | |
| T Velorum | 8 34.4 | —47 01 | 7.6— 8.5 | 4 15.3 | 5 6 | 14 12 | 19 4 | 28 11 | | | | |
| V Velorum | 9 19.2 | —55 32 | 7.5— 8.2 | 4 08.9 | 8 20 | 17 14 | 26 7 | | | | | |
| Z Leonis | 9 46.4 | +27 22 | 7.9— 9.6 | 56 08.7 | 3 5 | | | | | | | |
| RR Leonis | 10 02.1 | +24 29 | 9.1—10.1 | 0 10.9 | 5 18 | 12 14 | 19 8 | 26 3 | | | | |
| SU Draconis | 11 32.2 | +67 53 | 8.9— 9.6 | 0 15.8 | 1 19 | 8 10 | 21 15 | 28 5 | | | | |
| S Muscæ | 12 07.4 | —69 36 | 6.4— 7.3 | 9 15.8 | 2 20 | 12 21 | 22 3 | 31 19 | | | | |
| SW Draconis | 12.8 | +70 04 | 8.8— 9.6 | 0 13.7 | 1 22 | 9 21 | 17 21 | 25 20 | | | | |
| T Crucis | 15.9 | —61 44 | 6.8— 7.6 | 6 17.6 | 6 9 | 13 3 | 19 20 | 26 13 | | | | |
| R Crucis | 18.1 | —61 04 | 6.8— 7.9 | 5 19.8 | 6 9 | 12 5 | 23 20 | 29 16 | | | | |
| S Crucis | 12 48.4 | —57 53 | 6.5— 7.6 | 4 16.6 | 3 13 | 12 22 | 22 7 | 31 17 | | | | |
| W Virginis | 13 20.9 | — 2 52 | 8.7—10.4 | 17 06.5 | | 15 7 | | | | | | |
| SS Hydræ | 25.0 | —23 08 | 7.4— 8.1 | 8 04.8 | 3 12 | 11 17 | 19 22 | 28 3 | | | | |
| RV Urs. Maj. | 13 29.4 | +54 31 | 9.2— 9.9 | 0 11.2 | 4 19 | 11 20 | 18 20 | 25 21 | | | | |
| ST Virginis | 14 22.5 | — 0 27 | 10.3—11.4 | 0 09.9 | 4 5 | 11 15 | 19 1 | 26 10 | | | | |
| V Centauri | 25.4 | —56 27 | 6.4— 7.8 | 5 11.9 | 2 7 | 13 6 | 18 18 | 29 18 | | | | |
| RS Bootis | 29.3 | +32 11 | 8.9—10.0 | 0 09.1 | 2 13 | 10 2 | 17 15 | 25 4 | | | | |
| R Trian.Austr. | 15 10.8 | —66 08 | 6.7— 7.4 | 3 09.3 | 2 3 | 8 21 | 22 11 | 29 6 | | | | |
| S Trian.Austr. | 15 52.2 | —63 29 | 6.4— 7.4 | 6 07.8 | 1 18 | 8 2 | 20 17 | 27 1 | | | | |
| S Normæ | 16 10.6 | —57 39 | 6.6— 7.6 | 9 18.1 | 6 8 | 16 2 | 25 20 | | | | | |
| RW Draconis | 33.7 | +58 03 | 9.6—10.8 | 0 10.6 | 6 5 | 15 2 | 23 22 | | | | | |
| RV Scorpii | 16 51.8 | —33 27 | 6.7— 7.4 | 6 01.5 | 2 2 | 8 4 | 20 7 | 26 8 | | | | |
| X Sagittarii | 17 41.3 | —27 48 | 4.4— 5.0 | 7 00.3 | 7 16 | 14 16 | 21 16 | 28 16 | | | | |
| Y Ophiuchi | 47.3 | — 6 07 | 6.1— 6.5 | 17 02.9 | | 18 8 | | | | | | |
| W Sagittarii | 17 58.6 | —29 35 | 4.3— 5.1 | 7 14.3 | 8 15 | 16 6 | 23 20 | 31 10 | | | | |
| Y Sagittarii | 18 15.5 | —18 54 | 5.4— 6.2 | 5 18.6 | 6 2 | 11 20 | 23 10 | 29 4 | | | | |
| U Sagittarii | 26.0 | —19 12 | 6.5— 7.3 | 6 17.9 | 6 10 | 13 4 | 19 22 | 26 16 | | | | |
| Y Scuti | 32.6 | — 8 27 | 8.7— 9.2 | 10 08.3 | 1 4 | 11 13 | 21 21 | | | | | |
| RZ Lyræ | 39.9 | +32 42 | 9.9—11.2 | 0 12.3 | 7 14 | 15 6 | 22 22 | 30 14 | | | | |
| RT Scuti | 44.1 | —10 30 | 9.1— 9.7 | 0 11.9 | 1 5 | 8 16 | 23 13 | 30 23 | | | | |
| κ Pavonis | 18 46.6 | —67 22 | 3.8— 5.2 | 9 02.2 | 6 16 | 15 18 | 24 20 | | | | | |
| U Aquilæ | 19 24.0 | — 7 15 | 6.2— 6.9 | 7 00.6 | 8 0 | 15 0 | 22 1 | 29 1 | | | | |
| XZ Cygni | 19 30.4 | +56 10 | 8.6— 9.3 | 0 11.2 | 5 2 | 12 2 | 19 2 | 26 2 | | | | |
| U Vulpec. | 32.2 | +20 07 | 6.5— 7.6 | 7 23.5 | 6 4 | 14 3 | 22 3 | 30 3 | | | | |
| SU Cygni | 40.8 | +29 01 | 6.2— 7.0 | 3 20.3 | 2 4 | 9 20 | 17 13 | 25 6 | | | | |
| η Aquilæ | 47.4 | + 0 45 | 3.7— 4.5 | 7 04.2 | 4 3 | 11 7 | 18 11 | 25 15 | | | | |
| S Sagittæ | 51.5 | +16 22 | 5.6— 6.4 | 8 09.2 | 3 22 | 12 7 | 20 16 | 29 1 | | | | |
| X Vulpec. | 19 53.3 | +26 17 | 9.5—10.5 | 6 07.7 | 2 23 | 9 7 | 21 22 | 28 6 | | | | |
| X Cygni | 20 39.5 | +35 14 | 6.0— 7.0 | 16 09.3 | 1 15 | 17 1 | | | | | | |
| T Vulpec. | 47.2 | +27 52 | 5.5— 6.1 | 4 10.5 | 3 16 | 12 13 | 21 10 | 30 7 | | | | |
| UY Cygni | 52.3 | +30 03 | 9.6—10.4 | 0 13.5 | 4 21 | 12 4 | 19 11 | 26 18 | | | | |
| RV Capric. | 55.9 | —15 37 | 9.2—10.1 | 0 10.7 | 5 6 | 12 10 | 19 13 | 26 17 | | | | |
| TX Cygni | 20 56.4 | +42 12 | 8.5— 9.7 | 14 17.4 | 4 4 | | 18 21 | | | | | |
| VY Cygni | 21 00.4 | +39 34 | 8.8— 9.5 | 7 20.6 | 5 23 | 13 20 | 21 17 | 29 13 | | | | |
| SW Aquarii | 10.2 | — 0 20 | 9.9—10.8 | 0 11.0 | 6 9 | 13 6 | 20 4 | 27 1 | | | | |
| VZ Cygni | 21 47.7 | +42 40 | 8.2— 9.2 | 4 20.7 | 9 0 | 18 18 | 28 11 | | | | | |
| Y Lacertæ | 22 05.2 | +50 33 | 9.1— 9.6 | 4 07.8 | 5 18 | 13 23 | 22 15 | 31 6 | | | | |
| δ Cephei | 25.5 | +57 54 | 3.7— 4.6 | 5 08.8 | 5 2 | 15 19 | 21 4 | 31 22 | | | | |
| Z Lacertæ | 36.9 | +56 18 | 8.2— 9.0 | 10 21.1 | 2 10 | 13 8 | 24 5 | | | | | |
| RR Lacertæ | 37.5 | +55 55 | 8.5— 9.2 | 6 10.1 | 3 10 | 9 20 | 22 16 | 29 2 | | | | |
| V Lacertæ | 44.5 | +55 48 | 8.5— 9.5 | 4 23.6 | 8 16 | 18 15 | 28 15 | | | | | |
| X Lacertæ | 22 45.0 | +55 54 | 8.2— 8.6 | 5 10.7 | 2 6 | 13 4 | 18 14 | 29 12 | | | | |
| SW Cassiop. | 23 03.7 | +58 11 | 9.2— 9.7 | 5 10.6 | 4 0 | 14 21 | 20 7 | 31 4 | | | | |
| RS Cassiop. | 32.6 | +61 52 | 9.0—11.0 | 6 07.1 | 1 19 | 8 3 | 20 17 | 27 0 | | | | |
| RY Cassiop. | 47.2 | +58 11 | 9.3—11.8 | 12 03.4 | 3 23 | 16 2 | 28 5 | | | | | |
| V Cephei | 23 51.7 | +82 38 | 6.0— 7.0 | 0 23.9 | 3 10 | 10 9 | 24 8 | 31 8 | | | | |

## Minima of Variable Stars of Short Period.

[Calculated by members of the classes in Astronomy at Carleton College.]

Given to the nearest hour in Greenwich civil time; to obtain Eastern Standard time subtract $5^h$; Central Standard time $6^h$, etc.

| Star | R.A. 1900 | Decl. 1900 | Magnitude | Approx. Period | Greenwich civil times of Minima in 1927 December | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | h m | ° ′ | | d h | d h | d h | d h | d h | d h | d h | d h | d h |
| SY Androm. | 0 08.0 | +43 09 | 9.5—13.0 | 34 21.8 | | | 17 12 | | | | | |
| RT Sculptor. | 31.5 | —26 13 | 9.6—10.5 | 0 12.3 | 1 14 | | 9 6 | | 16 23 | | 24 14 | |
| U Cephei | 0 53.4 | +81 20 | 7.0— 9.0 | 2 11.8 | 1 9 | | 8 20 | | 23 19 | | 31 7 | |
| Z Persei | 2 33.7 | +41 46 | 9.4—12 | 3 01.4 | 1 3 | | 13 9 | | 19 12 | | 31 17 | |
| TW Cassiop. | 37.6 | +65 19 | 8.2— 9.0 | 1 10.3 | 3 23 | | 12 12 | | 21 2 | | 29 16 | |
| RY Persei | 39.0 | +47 43 | 8.0—10.3 | 6 20.7 | 7 20 | | 14 17 | | 21 13 | | 28 10 | |
| RZ Cassiop. | 39.9 | +69 13 | 6.9— 8.1 | 1 04.7 | 4 11 | | 11 15 | | 18 20 | | 26 0 | |
| TX Cassiop. | 44.4 | +62 22 | 9.4—10.1 | 2 22.2 | 5 6 | | 14 1 | | 22 20 | | 31 15 | |
| ST Persei | 53.7 | +38 47 | 8.5—10.5 | 2 15.6 | 2 15 | | 10 14 | | 18 12 | | 26 11 | |
| RX Cassiop. | 2 58.8 | +67 11 | 8.6— 9.1 | 32 07.6 | | | | | | | 29 23 | |
| Algol | 3 01.7 | +40 34 | 2.3— 3.5 | 2 20.8 | 8 19 | | 17 10 | | 26 1 | | | |
| RT Persei | 16.7 | +46 12 | 9.5—11.5 | 0 20.4 | 6 12 | | 13 7 | | 20 2 | | 26 12 | |
| λ Tauri | 55.1 | +12 12 | 3.3— 4.2 | 3 22.9 | 8 3 | | 16 1 | | 23 23 | | 31 20 | |
| RW Tauri | 3 57.8 | +27 51 | 7.1— [11 | 2 18.5 | 2 16 | | 10 23 | | 19 6 | | 27 14 | |
| RV Persei | 4 04.2 | +33 59 | 9.5—11.0 | 1 23.4 | 6 12 | | 14 9 | | 22 7 | | 30 4 | |
| RW Persei | 13.3 | +42 04 | 8.8—11.0 | 13 04.8 | 3 23 | | 17 4 | | | | 30 9 | |
| SZ Tauri | 31.4 | +18 20 | 7.2— 7.7 | 3 03.6 | 4 18 | | 11 2 | | 23 16 | | 29 23 | |
| RS Cephei | 4 48.6 | +80 06 | 9.5—12.0 | 12 10.1 | | | 11 15 | | 24 2 | | | |
| TT Aurigae | 5 02.8 | +39 27 | 7.8— 8.7 | 0 16.0 | 4 13 | | 11 5 | | 24 13 | | 31 5 | |
| RY Aurigae | 11.5 | +38 13 | 10.7—11.7 | 2 17.5 | 6 20 | | 15 1 | | 23 5 | | 31 9 | |
| RZ Aurigae | 42.9 | +31 40 | 10.6—13.3 | 3 00.3 | 6 3 | | 12 4 | | 24 5 | | 30 5 | |
| SV Tauri | 45.8 | +28 05 | 9.4—11.0 | 2 04.0 | 4 5 | | 12 21 | | 21 13 | | 30 5 | |
| Z Orionis | 50.2 | +13 40 | 9.7—10.7 | 5 04.9 | 7 6 | | 17 15 | | 28 1 | | | |
| SV Gemin. | 54.6 | +24 28 | 9.8— [11 | 4 00.2 | 1 20 | | 9 20 | | 17 21 | | 25 21 | |
| RW Gemin. | 5 55.4 | +23 08 | 9.5—11.0 | 2 20.8 | 5 12 | | 11 6 | | 22 17 | | 28 10 | |
| U Columbæ | 6 11.2 | —33 03 | 9.2—10.0 | 2 19.2 | 1 8 | | 12 12 | | 18 3 | | 29 8 | |
| SX Gemin. | 22.0 | +20 37 | 10.8—11.5 | 1 08.8 | 6 4 | | 14 9 | | 22 14 | | 30 19 | |
| RW Monoc. | 29.3 | + 8 54 | 9.0—10.8 | 1 21.7 | 6 17 | | 14 8 | | 21 22 | | 29 14 | |
| RX Gemin. | 43.6 | +33 21 | 8.8— 9.6 | 12 05.0 | 7 11 | | 19 16 | | 31 21 | | | |
| RU Monoc. | 6 49.4 | — 7 28 | 9.8—10.5 | 0 21.5 | 7 12 | | 14 15 | | 21 20 | | 29 0 | |
| R Can. Maj. | 7 14.9 | —16 12 | 5.8— 6.4 | 1 03.3 | 3 15 | | 10 10 | | 24 1 | | 30 21 | |
| RY Gemin. | 21.7 | +15 52 | 8.9— [10 | 9 07.2 | 8 17 | | 18 0 | | 27 8 | | | |
| Y Camelop. | 27.6 | +76 17 | 9.5—12 | 3 07.3 | 3 18 | | 10 9 | | 23 14 | | 30 5 | |
| TX Gemin. | 30.3 | +17 08 | 10.0—11.9 | 2 19.2 | 1 16 | | 10 1 | | 18 11 | | 26 20 | |
| RR Puppis | 43.5 | —41 08 | 9.4—10.7 | 6 10.3 | 5 2 | | 11 12 | | 24 9 | | 30 19 | |
| V Puppis | 7 55.4 | —48 58 | 4.1— 4.8 | 1 10.9 | 2 14 | | 9 21 | | 24 10 | | 31 16 | |
| X Carinæ | 8 29.1 | —58 53 | 7.9— 8.7 | 0 13.0 | 5 1 | | 13 4 | | 21 7 | | 29 10 | |
| S Cancri | 8 38.2 | +19 24 | 8.2—10 | 9 11.6 | 9 18 | | 19 6 | | 28 17 | | | |
| RX Hydræ | 9 00.8 | — 7 52 | 9.1—10.5 | 2 06.8 | 5 19 | | 12 15 | | 19 16 | | 26 8 | |
| S Velorum | 29.4 | —44 46 | 7.8— 9.3 | 5 22.4 | 6 11 | | 12 10 | | 24 7 | | 30 5 | |
| Y Leonis | 9 31.1 | +26 41 | 9.3—11.2 | 1 16.5 | 2 11 | | 9 5 | | 22 17 | | 29 11 | |
| RR Velorum | 10 17.8 | —41 36 | 10.0—10.9 | 1 20.5 | 1 12 | | 8 23 | | 23 18 | | 31 4 | |
| SS Carinæ | 10 54.2 | —61 23 | 12.2—12.8 | 3 07.2 | 3 14 | | 10 4 | | 23 9 | | 30 0 | |
| ST Urs. Maj. | 11 22.4 | +45 44 | 6.7— 7.2 | 8 19.2 | 1 17 | | 10 12 | | 19 8 | | 28 3 | |
| RW Urs. Maj. | 35.4 | +52 34 | 10.3—11.4 | 7 07.9 | 2 1 | | 9 9 | | 24 1 | | 31 9 | |
| Z Draconis | 11 39.8 | +72 49 | 9.9—13.6 | 1 08.6 | 1 23 | | 8 18 | | 22 7 | | 29 2 | |
| RZ Centauri | 12 55.6 | —64 05 | 8.5— 8.9 | 1 21.0 | 6 21 | | 14 9 | | 21 21 | | 29 9 | |
| RS Can. Ven. | 13 06.3 | +36 28 | 7.5—12.5 | 4 19.1 | 5 19 | | 15 9 | | 24 23 | | | |
| SS Centauri | 13 07.2 | —63 37 | 8.8—10.4 | 2 11.5 | 5 2 | | 12 14 | | 20 1 | | 27 11 | |
| SX Hydræ | 39.0 | —26 23 | 8.6—12.7 | 2 21.5 | 9 10 | | 18 2 | | 26 18 | | | |

**Minima of Variable Stars of Short Period—Continued.**

| Star | R.A. 1900 | Decl. 1900 | Magnitude | Approx. Period | Greenwich civil times of Minima in 1927 December | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | h m | ° ′ | | d h | d h | d h | d h | d h | d h | d h |
| δ Libræ | 14 55.6 | — 8 07 | 4.8— 6.2 | 2 07.9 | 4 17 | 11 17 | 18 17 | 25 17 | | |
| U Coronæ | 15 14.1 | +32 01 | 7.6— 8.7 | 3 10.9 | 5 6 | 12 3 | 19 1 | 25 23 | | |
| TW Draconis | 15 32.4 | +64 14 | 7.3— 8.9 | 2 19.4 | 1 0 | 9 10 | 17 20 | 26 6 | | |
| SS Libræ | 15 43.4 | —15 14 | 9.3—11.5 | 0 18.4 | 5 0 | 12 5 | 19 9 | 26 13 | | |
| SW Ophiuchi | 16 11.1 | — 6 44 | 9.2—10.0 | 2 10.7 | 7 22 | 15 6 | 22 14 | 29 22 | | |
| SX Ophiuchi | 12.6 | — 6 25 | 10.5—11.2 | 2 01.5 | 6 2 | 14 9 | 22 15 | 30 21 | | |
| R Aræ | 31.1 | —56 48 | 6.8— 7.9 | 4 10.2 | 6 5 | 15 2 | 23 22 | | | |
| TT Herculis | 16 49.9 | +17 00 | 8.9— 9.3 | 20 18.1 | | 16 2 | | | | |
| TU Herculis | 17 09.8 | +30 50 | 9.5—12 | 2 06.4 | 1 2 | 7 22 | 21 12 | 28 7 | | |
| U Ophiuchi | 11.5 | + 1 19 | 6.0— 6.7 | 1 16.2 | 1 7 | 9 17 | 18 2 | 26 12 | | |
| *u* Herculis | 13.6 | +33 12 | 4.6— 5.4 | 2 01.2 | 3 21 | 10 0 | 22 7 | 28 11 | | |
| TX Herculis | 15.4 | +42 00 | 8.3— 9.0 | 2 01.4 | 4 8 | 10 13 | 22 22 | 29 2 | | |
| RV Ophiuchi | 29.8 | + 7 19 | 9. —12 | 3 16.5 | 7 0 | 14 9 | 21 18 | 29 3 | | |
| SZ Herculis | 36.0 | +33 01 | 9.5—10.3 | 0 19.6 | 6 12 | 14 16 | 22 21 | 30 1 | | |
| TX Scorpii | 48.6 | —34 13 | 7.5— 8.2 | 0 22.6 | 5 5 | 12 18 | 20 7 | 27 19 | | |
| UX Herculis | 49.7 | +16 57 | 8.8—10.5 | 1 13.2 | 5 12 | 13 6 | 21 0 | 28 18 | | |
| Z Herculis | 53.6 | +15 09 | 7.1— 7.9 | 3 23.8 | 5 23 | 13 22 | 29 22 | 31 21 | | |
| WX Sagittarii | 53.6 | —17 24 | 9.2—10.8 | 2 03.1 | 4 15 | 13 3 | 21 16 | 30 4 | | |
| WY Sagittarii | 17 54.9 | —23 01 | 9.5—10.6 | 4 16.0 | 2 16 | 13 0 | 21 8 | 30 17 | | |
| SX Draconis | 18 03.0 | +58 23 | 9.3—10.5 | 5 04.1 | 2 22 | 13 6 | 18 10 | 28 18 | | |
| RS Sagittarii | 11.0 | —34 08 | 5.9— 6.3 | 2 10.0 | 2 21 | 10 2 | 24 14 | 31 20 | | |
| V Serpentis | 11.1 | —15 34 | 9.5—11.1 | 3 10.9 | 4 5 | 11 3 | 24 23 | 31 20 | | |
| RZ Scuti | 21.1 | — 9 15 | 7.4— 8.3 | 15 03.2 | 8 14 | | 23 18 | | | |
| RZ Draconis | 21.8 | +58 50 | 9.5—10.2 | 0 13.2 | 5 1 | 10 5 | 24 13 | 31 17 | | |
| RX Herculis | 26.0 | +12 32 | 7.0— 7.6 | 0 21.3 | 7 11 | 14 14 | 21 17 | 28 19 | | |
| SX Sagittarii | 39.7 | —30 36 | 8.7— 9.8 | 2 01.8 | 3 3 | 11 11 | 19 18 | 28 2 | | |
| RR Draconis | 40.8 | +62 34 | 9.3—13 | 2 19.9 | 8 5 | 16 17 | 25 5 | | | |
| RS Scuti | 43.7 | —10 21 | 9.3—10.3 | 0 15.9 | 2 14 | 9 6 | 15 21 | 22 12 | | |
| *β* Lyræ | 46.4 | +33 15 | 3.4— 4.1 | 12 21.8 | 5 18 | | 18 6 | 31 3 | | |
| U Scuti | 18 48.9 | —12 44 | 9.1— 9.6 | 0 22.9 | 4 2 | 11 17 | 19 8 | 27 0 | | |
| RX Draconis | 19 01.1 | +58 35 | 9.3—10.2 | 1 21.4 | 5 20 | 13 10 | 21 0 | 28 14 | | |
| RV Lyræ | 12.5 | +32 15 | 11. —12.8 | 3 14.4 | 2 18 | 9 23 | 24 8 | 31 13 | | |
| RS Vulpec. | 13.4 | +22 16 | 6.9— 8.0 | 4 11.4 | 4 2 | 13 1 | 22 0 | 30 23 | | |
| U Sagittæ | 14.4 | +19 26 | 6.5— 9.0 | 3 09.1 | 5 16 | 12 10 | 19 5 | 25 23 | | |
| Z Vulpec. | 17.5 | +25 23 | 7.3— 8.5 | 2 10.9 | 5 22 | 13 7 | 20 16 | 28 0 | | |
| TT Lyræ | 24.3 | +41 30 | 9.4—11.6 | 5 05.8 | 3 11 | 13 23 | 19 5 | 29 17 | | |
| UZ Draconis | 26.1 | +68 44 | 9.0— 9.8 | 1 15.1 | 1 18 | 8 7 | 21 8 | 27 20 | | |
| SY Cygni | 19 42.7 | +32 28 | 10. —12 | 6 00.2 | 5 22 | 11 22 | 23 23 | 29 23 | | |
| WW Cygni | 20 00.6 | +41 18 | 9.3—13.4 | 3 07.6 | 4 16 | 11 7 | 24 14 | 31 5 | | |
| SW Cygni | 03.8 | +46 01 | 9. —11.7 | 4 13.8 | 3 4 | 12 7 | 21 11 | 30 14 | | |
| VW Cygni | 11.4 | +34 12 | 9.8—11.8 | 8 10.3 | 2 20 | 11 6 | 19 16 | 28 2 | | |
| RW Capric. | 12.2 | —17 59 | 8.8—10.6 | 3 09.4 | 5 15 | 12 9 | 19 5 | 25 23 | | |
| UW Cygni | 19.6 | +42 55 | 10.5—13 | 3 10.8 | 3 16 | 10 14 | 24 9 | 31 7 | | |
| V Vulpec. | 32.3 | +26 15 | 8.2— 9.8 | 37 19.0 | 1 23 | | | | | |
| W Delphini | 33.1 | +17 56 | 9.4—12.1 | 4 19.4 | 4 18 | 14 9 | 19 4 | 28 19 | | |
| RR Delphini | 38.9 | +13 35 | 10.5—11.8 | 4 14.4 | 1 14 | 10 19 | 19 23 | 29 4 | | |
| Y Cygni | 48.1 | +34 17 | 7.1— 7.9 | 2 23.9 | 5 13 | 14 12 | 23 12 | | | |
| WZ Cygni | 49.3 | +38 27 | 9.9—10.8 | 0 14.0 | 5 16 | 13 7 | 20 21 | 28 11 | | |
| RR Vulpec. | 20 50.5 | +27 32 | 9.6—11.0 | 5 01.2 | 2 7 | 12 10 | 22 12 | | | |
| RY Aquarii | 21 14.8 | —11 14 | 8.8—10.4 | 1 23.2 | 2 8 | 10 5 | 18 2 | 25 22 | | |
| UZ Cygni | 55.2 | +43 52 | 8.9—11.6 | 31 07.3 | | 14 17 | | | | |
| RT Lacertæ | 21 57.4 | +43 24 | 9.1—10.5 | 5 01.7 | 2 21 | 13 1 | 18 2 | 28 6 | | |
| RW Lacertæ | 22 40.6 | +49 08 | 10.2—11.2 | 5 04.4 | 1 19 | 12 4 | 17 8 | 27 17 | | |
| VW Pegasi | 51.7 | +32 42 | 10.0—10.6 | 5 06.4 | 2 12 | 13 1 | 18 7 | 28 20 | | |
| Y Piscium | 23 29.3 | + 7 22 | 9.0—12.0 | 3 18.4 | 6 1 | 13 13 | 21 2 | 28 15 | | |
| TW Androm. | 23 58.2 | +32 17 | 8.6—11.5 | 4 02.9 | 7 1 | 15 7 | 23 13 | 31 19 | | |

## COMET NOTES.

By G. VAN BIESBROECK.

COMET SCHAUMASSE, the third periodic comet expected to return this year, was found by the writer on October 4 on a pair of plates exposed with the Bruce telescope.

It will be remembered that this comet was first discovered in the fall of 1911 by the French astronomer Schaumasse at the Nice Observatory. Computations by G. Fayet and the discoverer established its periodic character and showed that it was to return after eight years. This prediction was verified in 1919 when the same discoverer picked up the object on October 29 but it was then more than ten degrees from the computed position. That time it was badly situated and very few observations were obtained, the last one being on January 1, 1920, by the writer at the Yerkes Observatory. G. Merton of Greenwich has deduced the orbit by combining the two apparitions of the comet and allowing for the perturbations which had been considerable in 1913, when the object passed within 0.35 astronomical units of Jupiter. By carrying the perturbations further to the present epoch he was able to make an accurate prediction for this return and this has now been beautifully verified since the observations indicate for the time of perihelion October 1.43 U.T. (letter by A. C. D. Crommelin) in almost perfect agreement with Merton's computed value of October 1.54 (*Monthly Notices* **87**, 565, 1927). His elements are:

$$\left.\begin{aligned} T &= 1927\ \text{Oct.}\ 1.54\ \text{U.T.} \\ \omega &= 46^\circ\ 3'\ 38'' \\ \Omega_\odot &= 90\ \ 34\ \ 33 \\ i &= 14\ \ 43\ \ 10 \\ \phi &= 44^\circ\ 55'\ 38'' \\ \text{Log. } a &= 0.60025\ (P = 7.9501\ \text{years}) \\ \text{Log. } q &= 0.06829 \\ e &= 0.70621 \end{aligned}\right\} 1927.0$$

The comet is a difficult object having hardly any nucleus but appearing as a diffuse coma nearly 30″ in diameter. It is therefore hard to estimate its brightness and besides the observations have to be made at low altitudes above the horizon. The angular distance from the sun is small and the object can be observed only for a short interval of time before dawn. By comparison with the stars recorded on the plate the brightness was estimated as corresponding to that of a $12^M$ star.

After locating the object on October 4 I was able to trace it back on a plate taken here with the 24-inch reflector on September 23 on which it is so faint that on previous inspection the presence of the new visitor had not been recognized. Up to date the following photographic positions have been secured with the reflector, except the one of October 4 which was measured on a 10″ Bruce plate.

| 1927 U.T. | α | δ |
|---|---|---|
| | h m s | ° ′ ″ |
| Sept. 23.42492 | +10 20 27.3: | +16 2 35: |
| Oct. 4.43255 | 11 6 2.53: | 12 57 59.5: |
| 8.44870 | 11 21 40.82 | 11 46 22.1 |
| 19.45071 | 12 3 5.71 | 8 22 5.4 |
| 21.45414 | +12 10 23.97 | + 7 44 9.6 |

At the time when it was found, near $\theta$ Leonis, the comet was nearly at its brightest. Moving eastward across Leo and Virgo, it will enter Libra in the beginning

of December and then rise somewhat earlier with respect to the sun but at the same time it is expected to become fainter on account of the increased distance from both sun and earth. The comet will therefore remain a difficult object in the morning sky. The following ephemeris has been received from Dr. A. C. D. Crommelin:

| $0^h$ U.T. | $\alpha$ | $\delta$ | Log. $r$ | Log. $\Delta$ |
|---|---|---|---|---|
| | h m s | ° ′ | | |
| 1927 Nov. 3 | 12 54 27.1 | + 3 48.3 | 0.0960 | 0.3025 |
| 7 | 13 7 49.5 | 2 35.6 | | |
| 11 | 20 53.0 | 1 24.6 | 0.1096 | 0.3084 |
| 15 | 33 38.3 | + 0 15.7 | | |
| 19 | 46 4.9 | − 0 50.8 | 0.1248 | 0.3146 |
| 23 | 13 58 12.5 | 1 54.7 | | |
| 27 | 14 10 1.8 | 2 55.7 | 0.1412 | 0.3208 |
| Dec. 1 | 21 33.8 | 3 54.0 | | |
| 5 | 32 48.0 | 4 49.2 | 0.1583 | 0.3267 |
| 9 | 43 44.6 | 5 41.4 | | |
| 13 | 14 54 23.8 | 6 30.6 | 0.1759 | 0.3320 |
| 17 | 15 4 45.8 | 7 16.6 | | |
| 21 | 14 50.6 | 7 59.7 | 0.1935 | 0.3368 |
| 25 | 24 38.5 | 8 39.7 | | |
| 29 | 34 9.1 | 9 16.9 | 0.2110 | 0.3402 |
| 1928 Jan. 2 | 43 21.8 | 9 51.2 | | |
| 6 | 15 52 17.0 | −10 22.6 | 0.2282 | 0.3426 |

The recovery of the comet at this return is especially welcome since at the next return the conditions of visibility will be worse yet. So far no observations have been sent from other sources. On October 5 the following telegram was received here through the Harvard College Observatory:

"Oct. 3.1892 U.T. $11^h\,0^m\,20^s$ +14° 4′ $13^M$
Possibly comet Schaumasse. Please verify. Merton."

This position is more than half a degree north of the place of the comet. Could there have been an error in the transmission or is the object spurious? Nothing corresponding to it was found on our plates of October 4 and no further information is available to date.

The only other comet now visible is 1927 *d* (STEARNS) which is changing very little in appearance or brightness. The ephemeris given last month (p. 474) requires a correction of $-11^s$ and +4′.1 (Oct. 11). It will stay under observation for several months more but requires a large instrument to be seen.

For comet 1927 *f* (GALE) A. C. D. Crommelin has computed the following improved elements from observations at the Cape and Johannesburg extending to August 9 (Copenhagen Circ. 164):

$$\left.\begin{aligned} T &= 1927\ \text{June}\ 14.44366\ \text{U.T.} \\ \omega &= 209°\ 32'\ 37''.8 \\ \Omega &= 67\ 25\ 39.4 \\ i &= 11\ 47\ 30.5 \end{aligned}\right\} 1927.0$$

$$\text{Log. } a = 0.744608\ (\text{Period } 13.08917\ \text{years})$$

$$\phi = 51°\ 21'\ 3''.65$$

This makes an interesting addition to the list of periodic comets of the Saturnian family. Exposures showing stars down to $16^M$ were made here (Oct. 17) on the ephemeris position but no trace of the object could be seen, although its position must be well determined.

Before the end of the year two more periodic comets may come under ob-

servation. The field of the first, namely COMET ENCKE, has been photographed here on Oct. 19 and 20 according to the prediction by Matkiewicz in *Astr. Nachr.* **231**, 11 (1927). The position is about 2 minutes west and half a degree south of the place given by Seagrave's ephemeris on p. 413. But no indication of the comet has been found so far in either position. The distance from perihelion (1928 Feb. 20) is evidently too large yet.

The other object expected is PERIODIC COMET HOLMES. According to the work by the computing section of the British Astronomical Association, the perihelion is due on March 22, 1928 (letter by Dr. Crommelin). The following approximate ephemeris, deduced from the data of the *B.A.A. Handbook* for 1927, might help in searching for the object:

| | | α | δ |
|---|---|---|---|
| | | h m | ° ′ |
| 1927 Oct. | 22 | 19 4.3 | —30 35 |
| Nov. | 11 | 19 34.0 | —27 22 |
| Dec. | 1 | 20 7.1 | —24 1 |
| | 21 | 20 42.7 | —20 14 |
| | 41 | 21 19.1 | —16 3 |

This locates it now in Sagittarius in the southwestern evening sky. The southern observatories are better situated for making the search. For the northern stations the chances will be better next summer but the object will be faint.

Williams Bay, Wis., Oct. 24, 1927.

---

## Monthly Report of the American Association of Variable Star Observers, for the Month of September, 1927.

The smaller report this month is doubtless due to summer vacations ending, and schools and colleges beginning. It is to be hoped that the reports for the coming months will increase both in size and quality. Mira Ceti is at maximum, fourth magnitude, the three hundred and sixty-fifth return to maximum since it was first seen by Fabricius in 1596.

We regret to report that our Texas observer, Mr. Logan, has had to give up observing since he took up his residence in New York. Of course his loss will be made up by the acquisition of another good observer, but we dislike losing even one member in our observing ranks.

Although we continue to maintain our average as to numbers of observations, stars observed, and observers taking part, we do feel that we can make good use of some more AAVSO members, preferably those with telescopes and a desire to watch the caprices of our long list of variables. There is plenty of work yet to be done and we are glad to welcome to our ranks all those who think they can take an active part in our program. Inform the Secretary of the names and addresses of any prospective observers who may come to your attention.

The following observers have contributed to the results here presented: Baldwin, "Bl"; Benini, "Be"; Carr, "Ca"; Chandra, "Ch"; Cherrington, "Cb"; Clement, "Cl"; Ensor, "En"; Finsen, "Fi"; Freza, "Fr"; Gaebler, "Gb"; Gomi, "Go"; Goodsell, "Gs"; Iedema, "Ie"; Johnstone, "Jn"; Jones, "Jo"; Kohl, "Kl"; Kurtz, "Kz"; Lacchini, "L"; Leavens, "Ls"; Logan, "Lg"; Peltier, "Pt"; Rittenberg, "Rt"; Spears, "Sp"; White, "Wb"; Williams, "Wm"; and Yalden, "Ya".

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1927.

July 0 = J.D. 2425062; Aug. 0 = J.D. 2425093; Sept. 0 = J.D. 2425124.

| J.D.Est.Obs. | J.D.Est.Obs. | J.D.Est.Obs. | J.D.Est.Obs. | J.D.Est.Obs. | J.D.Est.Obs. |
|---|---|---|---|---|---|
| V SCL | — CAS | o CET | W TAU | S AUR | — AUR |
| *000339* | 004746b | *021403* | 042215 | 052034 | *062047* |
| 087[13.3 Bl | 120 10.5 Pt | 120 5.0 Pt | 124 9.6 Pt | 100 8.8 L | 100 9.1 L |
| S SCL | W CAS | 122 4.3 L | 128 9.8 Jo | 122 8.6 L | 122 9.3 L |
| *001032* | 004958 | 123 4.8 Ca | S TAU | 124 8.6 Pt | R MON |
| 087 10.6 Bl | 118 9.0 Jo | 140 4.2 Ca | 042309 | W AUR | 063308 |
| T CET | 120 8.7 Pt | S PER | 124 12.0 Pt | 052036 | 124 10.6 Pt |
| *001620* | 128 8.6 Jo | 021558 | T CAM | 100 9.8 L | S LYN |
| 100 5.5 L | 139 8.0 Jo | 112 10.4 Kl | 043065 | 122 11.0 L | 063558 |
| 122 5.4 L | U TUC | 115 10.3 Ch | 098 7.7 L | 124 11.1 Pt | 124 11.0 Pt |
| T AND | *005475* | 120 10.0 Pt | 119 8.6 Lg | T ORI | Y MON |
| 001726 | 087 10.0 Bl | R CET | 122 8.6 Lg | *053005a* | 065111 |
| 099[12.0 Ch | Z CET | *022000* | 124 8.4 Pt | 100 10.2 L | 124 11.7 Pt |
| T CAS | *010102* | 129[12.0 Ca | 126 8.8 Lg | 122 10.7 L | X MON |
| 001755 | 120 13.4 Pt | RR PER | R RET | 124 10.5 Pt | *065208* |
| 110 9.3 L | U SCL | 022150 | *043263* | S CAM | 122 8.0 L |
| 118 10.3 Jo | *010630* | 120 10.4 Pt | 086 12.1 Bl | 053068 | R LYN |
| 120 11.0 Pt | 087 10.4 Bl | R FOR | X CAM | 124 8.6 Pt | 065355 |
| 125 9.6 Ca | S CAS | *022426* | 043274 | RU AUR | 124 8.4 Pt |
| 128 10.5 Jo | 011272 | 087 11.7 Bl | 124 9.6 Pt | 053337 | R GEM |
| 139 10.4 Jo | 117 13.8 Cb | U CET | R DOR | 124[12.1 Pt | 070122a |
| R AND | 120 12.9 Pt | *022813* | *043562* | U AUR | 124 12 5 Pt |
| 001838 | 138[13.2 Cb | 120 11.8 Pt | 073 6.1 Bl | 053531 | Z GEM |
| 099 8.0 Ch | R PSC | RR CEP | 077 5.8 Bl | 124 12 8 Pt | 070122b |
| 117 7.2 Gb | 012502 | 022980 | 085 5.7 Bl | SU TAU | 124 12.6 Pt |
| 117 7.8 Rt | 116[10.6 Ch | 100[14.5 L | R CAE | 054319 | TW GEM |
| 118 7.8 L | RU AND | 114 12.7 Lg | *043738* | 100 9.7 L | 070122c |
| 120 7.5 Pt | 013238 | 117 12.6 Lg | 087 8.6 Bl | 122 9.8 L | 124 8.3 Pt |
| 128 7.8 L | 120 12.9 Pt | 119 12.6 Lg | R PIC | 124 9.5 Pt | R CMI |
| 139 7.7 L | Y AND | 122 12.6 Lg | *044349* | U ORI | 070310 |
| S TUC | 013338 | R TRI | 087 7.7 Bl | 054920a | 122 7.8 L |
| *001862* | 120 13.6 Pt | 023133 | V TAU | 123 7.0 Ca | V GEM |
| 087 10.3 Bl | X CAS | 120 10 0 Pt | 044617 | 124 7.6 Pt | 071713 |
| S CET | 014958 | W PER | 124 11.1 Pt | 140 6.5 Ca | 124 10.4 Pt |
| *001909* | 120 13.2 Pt | 024356 | R LEP | V CAM | S CMI |
| 099 10.4 Ch | U PER | 120 9.9 Pt | *045514* | 054974 | 072708 |
| 100 10.3 L | 015254 | 122 10.3 Cl | 122 7.3 L | 124 12.4 Pt | 122 11.5 L |
| 114 11.1 Lg | 120 8.9 Pt | 129 10.4 Ca | 124 6.9 Pt | Z AUR | 124 10.8 Pt |
| 117 12.8 Lg | 129 9.0 Jo | R HOR | 127 7.9 Wb | 055353 | T CMI |
| 119 12.9 Lg | 140 9.1 Ca | *025050* | 142 7.9 Wb | 117 10.0 Pt | 072811 |
| 120 12.1 Pt | R ARI | 087 12.7 Bl | V ORI | 119 10.0 Pt | 124 11.0 Pt |
| 122 12 0 L | 021024 | T HOR | 050003 | 124 10.0 Pt | S VOL |
| 122 12.7 Lg | 100 9.9 L | *025751* | 124 12.8 Pt | 125 10.0 Pt | *073173* |
| 126 12.7 Lg | 120 11.9 Pt | 087 12.1 Bl | T LEP | 127 9.9 Pt | 086 13.2 Bl |
| T PHE | 122 11.9 L | X CET | *050022* | 128 9.7 Pt | U CMI |
| *002546* | W AND | *031401* | 124 12 0 Pt | R OCT | 073508 |
| 087 12.2 Bl | 021143a | 100 9.7 L | S PIC | *055686* | 122 9.2 L |
| W SCL | 120 12.5 Pt | 120 11.0 Pt | *050848* | 073 11.0 Bl | 124 9.6 Pt |
| *002833* | T PER | 122 11.8 L | 087 8.6 Bl | 077 10.8 Bl | S GEM |
| 087 13.0 Bl | 021258 | 129 11.8 Ca | R AUR | 085 11.3 Bl | 073723 |
| RW AND | 115 8.8 Ch | Y PER | 050953 | 092 11 6 Bl | 124 9.4 Pt |
| 004132 | 120 8.5 Pt | 032043 | 124 9.8 Pt | X AUR | W PUP |
| 120 12.7 Pt | Z CEP | 120 9.9 Pt | 129 8.7 Ca | 060450 | *074241* |
| X SCL | 021281 | R PER | T PIC | 124 11.4 Pt | 073 8.5 Bl |
| *004435* | 120 13.2 Pt | 032335 | *051247* | V MON | 077 8.5 Bl |
| 087[13.6 Bl | o CET | 129 12.1 Ca | 087 10.8 Bl | *061702* | 085 9.0 Bl |
| RV CAS | *021403* | R TAU | T COL | 124 10.5 Pt | T GEM |
| 004746a | 100 6.6 L | 042209 | *051533* | | 074323 |
| 120 12.6 Pt | 114 5.4 Ch | 129[12.0 Ca | 087 11.2 Bl | | 124 9.0 Pt |

## Variable Star Observations Received During September, 1927.

| J.D.Est.Obs. | J.D.Est.Obs. | J.D.Est.Obs. | J.D.Est.Obs. | J.D.Est.Obs. | J.D.Est.Obs. |
|---|---|---|---|---|---|
| R Cnc | S Car | R UMa | R Hya | R Cen | RT Lib |
| 081112 | *100661* | 123160 | *132422* | *140959* | *150018* |
| 122 10.1 L | 083 5.7 En | 101 7.5 Ch | 078 5.1 En | 080 8.3 En | 114 8.8 Pt |
| R Cha | 085 5.5 Bl | 114 7.5 Pt | 080 5.0 En | 083 8.3 En | 117 9.0 Lg |
| *082476* | 092 6.0 En | 117 8.1 Cb | 084 4.8 En | 086 7.9 Bl | T Lib |
| 071 10.8 Bl | Z Car | 117 7.8 Kl | 085 4.8 Bl | 092 7.8 En | *150519* |
| 077 11.2 Bl | *101058* | 117 7.5 Rt | 092 4.6 En | U UMi | 117[12.8 Bl |
| 085 11.6 Bl | 080[12.3 En | 118 7.9 Ls | 094 4.6 Ch | 141567 | 122 11.3 Bl |
| 092 12.0 Bl | 086[12.6 Bl | 118 7.5 Ca | 113 4.3 Ch | 080 10.0 Wb | Y Lib |
| T Cnc | 092[12.3 En | 119 8.0 Kl | S Vir | 099 9.6 Ch | *150605* |
| 085120 | W Vel | 119 8.0 Ls | *132706* | 111 9.5 Ch | 111 12.2 L |
| 016 8.5 Fr | *101153* | 122 7.9 Kl | 087 8.6 Wm | 114 9.2 Pt | S Lib |
| 020 8.6 Fr | 086[13.0 Bl | 124 8.1 Cb | 100 8.9 Wm | 117 9.2 Wb | *151520* |
| 024 8.6 Fr | R UMa | 125 7.3 Ca | 100 9.0 Ch | 129 9.0 Gs | 098 8.9 L |
| T Pyx | 103769 | 129 8.2 Wb | 109 8.9 Lg | 129 8.8 Jo | 106 8.4 Ch |
| *090031* | 114 8.4 Pt | 129 8.0 Ls | 113 9.3 Ch | 138 9.0 Wb | 116 8.4 L |
| 086 [u Bl | 117 8.3 Cb | 134 7.7 Ca | 114 9.2 Wm | S Boo | S Ser |
| V UMa | 124 7.8 Cb | 138 8.5 Cb | 114 9.2 Lg | 141954 | 151714 |
| 090151 | 129 8.7 Ca | R Vir | 117 9.3 Lg | 098 12.6 L | 109 10.0 Lg |
| 094 10 2 L | V Hya | 123307 | 119 9.2 Lg | 111 11.9 Ch | 110 10.7 L |
| W Cnc | *104620* | 111 6.2 L | 122 9.1 Lg | 114 11.5 Pt | 114 10.1 Pt |
| 090425 | 071 8.5 Bl | 120 6.9 L | RV Cen | 116 11.6 L | 114 10.0 Lg |
| 122[11.0 L | 077 8.0 Bl | RS UMa | *133155* | 117 11.3 Kz | 117 9.8 Lg |
| RW Car | 085 8.4 Bl | 123459 | 071 8.9 Bl | V Boo | 118 9.5 Ca |
| *091868* | RS Hya | 114 13.1 Pt | 077 8.9 Bl | 142539a | 119 9.7 Lg |
| 080[12.2 En | *104628* | 117 13.5 Cb | 085 9.0 Bl | 099 9.5 Ch | 120 9.4 L |
| 086[12.8 Bl | 071 11.1 Bl | 124 13.5 Cb | T Cen | 110 9.2 L | 138 8.7 Ca |
| 093[12.2 En | 077 11.5 Bl | 138[13.2 Cb | *133633* | 114 9.4 Pt | S CrB |
| Y Vel | 085 11.6 Bl | S UMa | 073 6.2 Bl | 117 9.4 Kz | 151731 |
| *092551* | RS Car | 123961 | 077 6.4 Bl | 118 9.6 Ca | 087 12.7 Wm |
| 081[12.1 En | *110361* | 102 10.0 Jn | 078 7.2 En | 118 9.3 Ls | 108 12.4 Ch |
| 086[12.9 Bl | 080[12.3 En | 108 9.8 Jn | 083 7.4 En | 119 9.4 Ls | 114 10.4 Pt |
| 092[12.1 En | 092[12.3 En | 114 8.6 Pt | 085 7.4 Bl | 120 9.4 L | 114 11.6 Wm |
| R Car | RY Car | 116 8.8 Be | 092 7.6 En | 129 9.3 Ls | 122 9.9 Cl |
| *092962* | *111561* | 116 8.8 L | RT Cen | R Cam | 130 11.7 Wm |
| 071 5.1 Bl | 086[13.5 Bl | 117 8.7 Rt | *134226* | 142584 | RS Lib |
| 077 5.4 Bl | RS Cen | 117 9.1 Kl | 080 12.6 En | 091 8.7 Ch | *151822* |
| 078 5.4 En | *111661* | 117 8.6 Cb | 085 12.6 En | 132 8.2 Ca | 073 10.8 Bl |
| 083 5.5 En | 071 10.5 Bl | 118 8.5 Ca | 086 13.2 Bl | R Boo | 077 10.4 Bl |
| 085 5.8 Bl | 077 11.2 Bl | 118 9.0 Ls | 092 12.4 En | 143227 | 081 10.6 En |
| 092 5.6 En | 085 12.2 Bl | 119 9.1 Ls | R CVn | 099 8.6 Ch | 085 10.4 En |
| R LMi | X Cen | 119 8.8 Kl | 134440 | 114 9.4 Pt | 087 10.4 Bl |
| 093934 | *114441* | 122 8.8 Kl | 114 7.5 Pt | 117 9.4 Rt | 093 10.2 En |
| 122 10.1 L | 071 11.7 Bl | 124 8.3 Cb | 129 8.1 Ie | 118 9.4 Ls | 098 9.9 L |
| Z Vel | 086 12.5 Bl | 129 8.4 Ls | RX Cen | 118 9.5 Ca | 111 8.8 L |
| *094953* | W Cen | 138 7.8 Cb | *134536* | 138 10.3 Ca | 116 8.8 Be |
| 071 10.3 Bl | *115058* | U Oct | 073 10.5 Bl | Y Lup | RU Lib |
| 077 10.4 Bl | 071 8.7 Bl | *131283* | 077 10.6 Bl | *145254* | *152714* |
| 078 10.7 En | 077 8.8 Bl | 081[12.4 En | 086 11.1 Bl | 077 10.1 Bl | 088 8.3 Wm |
| 083 10.8 En | 078 8.6 En | 086 13.5 Bl | T Aps | 073 10.4 Bl | 098 7.8 Jo |
| 085 10.5 Bl | 083 9.2 En | V CVn | *134677* | 087 10.4 Bl | 107 8.1 Wm |
| 092 10.9 En | 085 9.4 Bl | 131546 | 087[13.2 Bl | S Aps | 109 7.5 Jo |
| RV Car | 093 10.2 En | 033 7.5 Go | RU Hya | *145971* | 114 8.3 Wm |
| *095563* | T CVn | 052 7.2 Go | *140528* | 073 10.1 Bl | 114 7.5 Pt |
| 086[13.1 Bl | 122532 | 053 7.2 Go | 080[12.5 En | 077 10.0 Bl | 121 8.2 Wm |
| S Car | 114 9.6 Pt | 061 7.2 Go | 086[13.5 Bl | 080 10.0 En | 122 7.5 Jo |
| *100661* | U Cen | R Hya | R Cen | 083 10.1 En | 130 8.7 Wm |
| 071 5.2 Bl | *122854* | *132422* | *140959* | 087 10.0 Bl | R Nor |
| 077 5.2 Bl | 086[13.0 Bl | 073 5 5 Bl | 073 8.7 Bl | 092 10.0 En | *152849* |
| 078 5.5 En | | 077 5 2 Bl | 077 8.4 Bl | | 080 12.8 En |

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1927.

| J.D.Est.Obs. | J.D.Est.Obs. | J.D.Est.Obs. | J.D.Est.Obs. | J.D.Est.Obs. | J.D.Est.Obs. |
|---|---|---|---|---|---|
| R NOR | R CRB | RR LIB | W SCO | RR OPH | Z OPH |
| *152849* | 154428 | *155018* | *160519* | *164319* | 171401 |
| 083 12.8 En | 117 6.0 Gb | 111 14.5 L | 087[13.0 Bl | 085 9.8 En | 123 9.2 Ca |
| 087 13.3 Bl | 117 6.1 Pt | RZ SCO | RU HER | 093 10.2 En | 126 8.9 Lg |
| 093 12.8 En | 117 5.8 Kz | *155823* | 160625a | 108 11.8 Pt | 136 8.8 Sp |
| X LIB | 117 6.2 Kl | 081 9.7 En | 114 12.3 Pt | 111 11.2 L | 138 8.4 Ca |
| *153020* | 118 6.1 Pt | 085 9.8 En | 116 12.0 Be | 122 11.8 L | 140 8.0 Ya |
| 087[12.9 Bl | 118 6.0 Ca | 093 10.0 En | 116 12.1 L | S HER | 144 8.3 Cl |
| W LIB | 118 6.2 Jo | 114 11.0 Pt | R SCO | 164715 | RS HER |
| *153215* | 119 6.0 Kl | Z SCO | *161122a* | 108 11.6 Pt | 171723 |
| 087 11.3 Bl | 119 6.5 Cb | *160021* | 081[12.6 En | 111 11.4 Ch | 114 10.0 Pt |
| 109 11.4 L | 119 6.1 Pt | 073 10.7 Bl | 087[13.0 Bl | 123 10.6 Ca | 118 9.6 Jo |
| 109 10.4 Lg | 120 6.1 Pt | 077 10.8 Bl | 094[12.6 En | 130 9 8 Ie | S OCT |
| 114 10.2 Lg | 120 5.9 Ca | 081 10.3 En | 108 11.5 Pt | 138 9.8 Ca | *172486* |
| 117 10 2 Lg | 120 6.0 Be | 085 10.1 En | S SCO | 140 10.3 Ya | 081[12.1 En |
| 119 10.4 Lg | 120 5.9 L | 087 10 2 Bl | *161122b* | 141 8.0 Cb | 087[13.0 Bl |
| 122 10.0 Lg | 122 5.9 L | 093 10.1 En | 073 11.1 Bl | RS SCO | 093[12.1 En |
| S UMI | 122 5.9 Ls | 111 10.1 L | 077 11.1 Bl | *164844* | RU OPH |
| 153378 | 122 6.0 Be | 122 10.2 L | 081 10.9 En | 073[12.0 Bl | 172809 |
| 114 9.8 Pt | 123 6.2 Cb | R HER | 085 10.8 En | 181[12.0 En | 114 11.6 Pt |
| 117 10.4 Rt | 123 6.0 Ca | 160118 | 087 10.6 Bl | 087 12.4 Bl | RT SER |
| 129 9.6 Jo | 123 6.1 Pt | 089 8.6 Ch | 093 10.7 En | 093[12.0 En | *173212* |
| 140 9.4 Ca | 123 6.0 Ls | 108 9.6 Cb | W CRB | RR SCO | 122 12.5 L |
| U LIB | 124 6.1 Pt | 114 9.5 Pt | 161138 | *165030* | RU SCO |
| *153620a* | 124 6.2 Cb | 118 9.5 Ch | 108 8.1 Pt | 073 6.4 Bl | *173543* |
| 073 9.4 Bl | 125 5.9 Ca | 129 10.5 Ie | 123 8.5 Ca | 077 6.7 Bl | 073 10.5 Bl |
| 077 9.4 Bl | 125 6.1 Pt | U SER | 128 8.7 Sp | 081 6.4 En | 087 10.4 Bl |
| 087 10.1 Bl | 125 6.0 Jn | 160210 | 129 8 7 Ie | 085 7.0 En | SV SCO |
| T NOR | 126 6.1 Pt | 114 12.6 Pt | 139 9.0 Ca | 087 7.3 Bl | *174135* |
| *153654* | 128 6.1 Pt | 125 11.8 Ca | 140 9.1 Ya | 093 7.2 En | 078[12.2 Bl |
| 049 9.0 Fi | 128 6.0 Ca | 128 11.7 Ie | S OPH | SS OPH | 087[13.0 Bl |
| Z LIB | 128 6.0 Jo | X SCO | *162816* | *165202* | W PAV |
| *154020* | 129 6.5 Gs | *160221a* | 087[13.3 Bl | 108 12.1 Pt | *174162* |
| 087[13.0 Bl | 129 6.1 Pt | 087 11.4 Bl | W HER | RV HER | 080 9.6 En |
| R CRB | 130 6.1 Pt | SX HER | 163137 | 165631 | 083 9.4 En |
| 154428 | 130 6.2 Wm | 160325 | 089 11.4 Ch | 108 13.7 Pt | 087 9.3 Bl |
| 033 5.6 Go | 132 6.0 Ca | 098 7.8 L | 108 11.0 Pt | RT SCO | 092 9.1 En |
| 057 5.8 Go | 134 5.9 Ca | 108 8.2 Pt | 115 10.5 Ch | *165636* | 095 9 0 En |
| 060 5.7 Go | 134 6.1 Pt | 114 8.4 Pt | 128 9.5 Sp | 087[13.0 Bl | RS OPH |
| 061 5.7 Go | 135 6.1 Pt | 115 8.4 Pt | 128 9.1 Jo | R OPH | 174406 |
| 081 6.0 Go | 136 6.1 Pt | 116 8.2 Be | 129 9.6 Ie | *170215* | 114 11.1 Pt |
| 094 6.9 Be | 136 6.0 Ca | 117 8.1 L | 129 9.5 Sp | 111[11.6 Ch | U ARA |
| 099 6.0 Be | 137 6.1 Pt | 117 8.5 Pt | 136 9.0 Sp | 125[11.6 Ca | *174551* |
| 099 6.1 Ch | 138 6.1 Pt | 118 8.5 Pt | 138 9.0 Sp | 140 10.4 Ca | 080[12.3 En |
| 102 6.0 Jn | 138 6.0 Ca | 119 8.7 Pt | 139 8.2 Jo | RT HER | 095[12.3 En |
| 106 6.1 Ch | 140 6.0 Ca | 120 8.8 Pt | 140 8.7 Ya | 170627 | RT OPH |
| 108 6.1 Pt | 142 6.0 Ca | 123 8.9 Pt | R DRA | 108 9.5 Pt | 175111 |
| 108 6.0 Jn | X CRB | 124 8.8 Pt | 163266 | 122 9.6 Cl | 119 12.6 Lg |
| 109 6.0 Be | 154536 | 125 8.7 Pt | 094 8.0 Ch | RW SCO | 122 12.7 Lg |
| 109 6.0 L | 114 9.6 Pt | 126 8.6 Pt | 108 7.8 Pt | *170833* | RY HER |
| 110 6.0 L | 128 9.7 Ie | 128 8.5 Pt | 116 8.1 Ch | 073 9.7 Bl | 175519 |
| 111 6.0 L | R SER | 129 8 8 Pt | 117 8.0 Rt | 078 9.8 Bl | 111 11.2 Ch |
| 113 6.0 Ch | 154615 | 130 8.9 Pt | 118 8.0 Jo | 087 9.5 Bl | 114 11.5 Pt |
| 114 6.1 Pt | 111[13.2 Ch | 134 8.8 Pt | 124 8.4 Cb | Z OPH | R PAV |
| 114 6.0 Be | 114 13.3 Pt | 135 8.8 Pt | 128 8.2 Jo | 171401 | *180363* |
| 114 6.0 Wm | V CRB | 136 8.9 Pt | 139 8.6 Jo | 114 9.5 Pt | 080 12.0 En |
| 115 6.2 Pt | 154639 | 137 8.8 Pt | 140 8.8 Ca | 114 9.8 Lg | 083 12.2 En |
| 116 6.0 Be | 114 7.0 Pt | 138 8.8 Pt | RR OPH | 117 9.5 Lg | 092[11.8 En |
| 116 6.0 L | 134 6.9 Ca | | *164319* | 119 9.6 Lg | |
| 117 6.0 Wb | 140 7.5 Ya | | 081 9.6 En | 122 9.5 Lg | |

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1927.

| J.D.Est.Obs. | J.D.Est.Obs. | J.D.Est.Obs. | J.D.Est.Obs. | J.D.Est.Obs. | J.D.Est.Obs. |
|---|---|---|---|---|---|
| T HER | R SCT | R SCT | ST SGR | S LYR | TY SGR |
| 180531 | *184205* | *184205* | *185437a* | 190925 | *191124* |
| 111 13.5 L | 108 5.5 Pt | 129 5.2 Sp | 109 12.9 Lg | 114[12.4 Ch | 087 10.1 Bl |
| 114 13.3 Pt | 109 5.0 Be | 129 5.6 Ca | 114 12.2 Ch | X LYR | S SGR |
| 123 13.0 Be | 109 5.1 L | 129 6.0 Gs | 123[14.0 L | 190926 | *191319a* |
| 123 13.0 L | 109 5.0 Lg | 130 5.5 Pt | R CRA | 114 8.9 Pt | 087[12.9 Bl |
| 129 12.3 Ca | 110 5.5 Pt | 131 5.6 Ca | *185537a* | RS LYR | 123[12.2 Ca |
| 140 11.1 Ca | 112 5.7 Rt | 132 5.3 Sp | 087 13.0 Bl | 190933a | SW SGR |
| 141 10.6 Cb | 112 5.3 Lg | 133 5.6 Ca | T CRA | 114 12.2 Ch | *191331* |
| W DRA | 113 5.4 Lg | 134 5.5 Pt | *185537b* | W AQL | 087 12.0 Bl |
| 180565 | 113 5.5 Pt | 135 5.7 Pt | 087[13.0 Bl | *191007* | TZ CYG |
| 114 11.0 Pt | 114 5.5 Pt | 135 5.6 Ca | Z LYR | 111[13.4 Ch | 191350 |
| TV HER | 114 5.5 Ca | 136 5.5 Sp | 185634 | 129[12.6 Ca | 114 11.0 Pt |
| 181031 | 114 5.4 Lg | 136 5.7 Pt | 114 12.3 Pt | T SGR | U LYR |
| 111 11.3 L | 115 5.5 Pt | 137 5.8 Pt | RT LYR | *191017* | 191637 |
| 123 9.8 L | 115 5.2 Lg | 137 5.8 Gb | 185737 | 099 10.0 Ch | 114 9.0 Pt |
| RY OPH | 116 5.3 Lg | 137 5.6 Ca | 114[12.0 Ch | 107 9.6 Ch | TY CYG |
| 181103 | 116 5.1 Be | 138 5.4 Cb | V AQL | 114 8.9 Pt | 192928 |
| 114 13.1 Pt | 116 5.5 Ch | 138 6.0 Pt | *185905* | R SGR | 108 9.7 Ch |
| 129[12.5 Ca | 117 5.8 Gb | 139 5.6 Ca | 117 7.0 Cb | *191019* | 114 9.5 Pt |
| W LYR | 117 5.5 Pt | 139 5.2 Jo | 119 7.2 Cb | 099 7.0 Ch | RT AQL |
| 181136 | 117 5.7 Rt | 139 5.7 Sp | 123 7.0 Cb | 107 6.8 Ch | 193311 |
| 114 12.0 Pt | 117 5.4 Ca | 141 5.8 Cb | 124 6.9 Cb | 112 6.9 Rt | 114 14.0 Pt |
| 116 11.4 L | 117 5.8 Cb | 142 5.7 Ca | 126 7.2 Cb | 114 6.8 Pt | R CYG |
| 128 10.1 Jo | 117 5.3 Lg | NOV AQL | 138 7.8 Cb | 114 6.6 Ca | 193449 |
| 139 9.0 Jo | 118 5.6 Pt | 184300 | 141 7.5 Cb | 117 7.5 Rt | 115 12.6 Pt |
| 140 9.2 Ca | 118 5.5 Jo | 114 11.5 Pt | R AQL | 123 7.7 Ls | 117 13 0 Cb |
| 141 8.0 Cb | 118 5.4 Lg | 114 10.5 Ch | 190108 | 123 7.5 Cb | 124 13.3 Cb |
| RV SGR | 119 5.4 Lg | 120 10.1 Be | 107 5.9 Ch | 128 7.5 Sp | 141 13.5 Cb |
| *182133* | 119 5.6 Pt | 126 11 3 Pt | 114 6.1 Pt | 129 7.6 Sp | RV AQL |
| 087 11.1 Bl | 119 5.5 Cb | 128 10.8 Ie | 129 7.0 Ca | 129 7.4 Ca | 193509 |
| SV HER | 120 5.6 Pt | 129 10.4 Ca | V LYR | 136 7.9 Sp | 115 10.1 Pt |
| 182224 | 120 5.0 L | 137 11.3 Pt | 190529a | 140 7.9 Ca | 117 9.9 Lg |
| 114 10.0 Pt | 120 5.3 Lg | S SCT | 114 10.5 Pt | RY SGR | 119 9.8 Lg |
| 116 10.0 En | 121 5.5 Pt | *184408* | RX SGR | *191033* | 126 9.6 Lg |
| 116 10.0 L | 121 5.3 Lg | 025 6.8 Fr | *190818* | 071 6.3 Bl | T PAV |
| X OPH | 122 5.4 Lg | 026 6.6 Fr | 099 10.4 Ch | 080 7.0 En | *193072* |
| 183308 | 123 5.5 Lg | 029 6.7 Fr | 107 10.2 Ch | 083 7.1 En | 080 10.8 En |
| 111 7.8 Ch | 123 5.7 Pt | 030 6.6 Fr | 109 10.4 Lg | 087 6.5 Bl | 083 11.2 En |
| 114 7.9 Pt | 123 5.6 Ca | 031 6.6 Fr | 114 9.9 Pt | 092 6.9 En | 087 11.4 Bl |
| 116 7.8 Be | 123 5.0 Be | 033 6.3 Fr | 114 10.7 Lg | 094 6.8 Ch | 092 11.5 En |
| 116 7.7 L | 123 5.1 Cb | 034 6.1 Fr | 117 9.8 Lg | 099 6.6 Ch | RT CYG |
| 117 8.4 Rt | 124 6.0 Cb | 051 6.5 Fr | 119 10.2 Lg | 108 6.5 Pt | 194048 |
| 117 8.0 Wb | 124 5.5 Pt | 053 6.4 Fr | 122 10.1 Lg | 109 6.6 L | 115 12.2 Pt |
| 118 7.8 Jo | 124 5.5 Lg | 054 6.4 Fr | 125 9.9 Lg | 110 6.4 Pt | 117 11.3 Cb |
| 128 7.7 Jo | 125 5.5 Lg | 055 6.5 Fr | 126 10.0 Lg | 111 6.8 Ch | 117 9.9 Rt |
| 129 7.9 Ca | 125 5.1 Jn | 066 6.9 Fr | RW SGR | 114 6.6 Pt | 139 10.5 Jo |
| 138 7.5 Wb | 125 5.5 Pt | 068 7.1 Fr | *190819a* | 115 6.9 Pt | χ CYG |
| 139 7.1 Jo | 125 5.6 Ca | 069 7.1 Fr | 107 9.6 Ch | 117 7.0 Pt | 194632 |
| RS DRA | 126 5.6 Pt | 072 6.4 Fr | 109 9.8 Lg | 118 7.0 Pt | 108 11.5 Ch |
| 184074 | 126 5.3 Lg | 075 6.6 Fr | 114 9.5 Pt | 122 7.4 L | 110 11.8 L |
| 111 7.4 Ch | 126 5.5 Cb | 077 6.7 Fr | 114 9.7 Lg | 123 7.4 Pt | 115 11.6 Pt |
| RV LYR | 127 5.5 Pt | 081 6.7 Fr | 117 9.5 Lg | 124 7.4 Pt | 140[11.6 Ca |
| 184134 | 127 5.3 Lg | 082 7.1 Fr | 119 9.9 Lg | 126 6.7 Pt | RR SGR |
| 114 12.6 Pt | 128 5.5 Pt | RX LYR | 122 9.7 Lg | 129 6.3 Pt | *194929* |
| 128 11 5 Ie | 128 5.2 Sp | 185032 | 125 9.6 Lg | 134 6.3 Pt | 087 6.8 Bl |
| R SCT | 128 5.5 Ie | 114[12.5 Ch | 126 9.6 Lg | 135 6.3 Pt | RU SGR |
| *184205* | 128 5.6 Jo | S CRA | TY AQL | 136 6.3 Pt | *195142* |
| 089 6.2 Ch | 129 5.4 Jo | *185437a* | 190907 | 137 6.3 Pt | 080 9.7 En |
| 106 5.8 Ch | 129 5.5 Pt | 087 12.5 Bl | 114 10.2 Pt | 138 6.4 Pt | 083 8.8 En |

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1927.

| J.D.Est.Obs. | J.D.Est.Obs. | J.D.Est.Obs. | J.D.Est.Obs. | J.D.Est.Obs. | J.D.Est.Obs. |
|---|---|---|---|---|---|
| RU SGR | RW AQL | U CYG | Y AQR | X CEP | RV CYG |
| *195142* | 200715b | 201647 | *203905* | 210382 | 213937 |
| 087 8.4 Bl | 126 9.0 Lg | 129 10.0 Wb | 109 12.5 Lg | 114 9.9 Ch | 094 6.9 L |
| 092 7.9 En | 128 9.3 Cl | 138 10.5 Sp | 114 12.4 Lg | RS AQR | 117 6.4 Pt |
| RR AQL | R TEL | 139 10.4 Ca | 117 12.1 Lg | *210504* | RR PEG |
| *195202* | *200747* | 139 9.5 Jo | 117 12.2 Pt | 123 13.8 L | 214024 |
| 115 9.2 Pt | 087 9.7 Bl | 141 10.6 Cb | 119 11.8 Lg | Z CAP | 117 14.0 Pt |
| 128 8.5 Cl | W CAP | U MIC | 122 11.7 Lg | *210516* | 141[12.5 Cl |
| RS AQL | *200822* | *202240* | 125 11.9 Lg | 117 10.3 Pt | R GRU |
| *195308* | 087[12.8 Bl | 087 11.5 Bl | 126 11.8 Lg | T CEP | *214247* |
| 129[12.8 Ca | Z AQL | Z DEL | T DEL | 210868 | 080 9.0 En |
| NOV CYG | *200906* | 202817 | 204016 | 091 6.7 Ch | 083 9.6 En |
| 195553 | 115 9.6 Pt | 117 14.1 Pt | 117 12.6 Pt | 100 6.2 Go | 087 9.4 Bl |
| 112[13.0 Ie | 119 9.7 Lg | SZ CYG | V AQR | 101 6.5 Ch | 092 9.8 En |
| 120[12.2 Pt | 126 10.6 Lg | 202946 | 204102 | 116 6.3 Ch | V PEG |
| 137[12.2 Pt | R SGE | 108 9.6 Pt | 114 8.8 Ch | 117 6.0 Wb | 215605 |
| Z CYG | 200916 | 110 9.5 Pt | 117 8.1 Pt | 117 5.9 Pt | 117 11.4 Pt |
| 195849 | 128 8.3 Cl | 113 8.8 Pt | W AQR | 118 6.4 Ca | U AQR |
| 110 11.5 Ch | RS CYG | 114 8.8 Pt | *204104* | 118 6.0 Jo | *215717* |
| 115 11.1 Pt | 200938 | 115 8.8 Pt | 123 11.5 L | 122 6.3 Go | 117 11.1 Pt |
| S TEL | 094 7.6 Ch | 117 9.0 Pt | U CAP | 127 6.4 Wb | RT PEG |
| *195855* | 107 7.4 Ch | 118 9.1 Pt | *204215* | 128 5.7 Jo | 215934 |
| 087 12.5 Bl | 110 7.4 Ch | 119 9.0 Pt | 087[13.1 Bl | 129 5.8 Ca | 110 9.4 Ch |
| SY AQL | 113 7.4 Ch | 120 9.0 Pt | T AQR | 138 5.9 Ca | 117 10.0 Pt |
| 200212 | 115 7.0 Pt | 121 9.1 Pt | *204405* | 140 6.3 Jo | RZ PEG |
| 115 13.0 Pt | 116 7.4 Ch | 123 9.5 Pt | 109 13.3 Lg | RR AQR | 220133b |
| 119 13.2 Lg | 116 7.1 L | 124 9.6 Pt | 111 13.5 Ch | *210903* | 117 9.0 Pt |
| 123[13.9 L | 118 7.5 Jo | 125 9.5 Pt | 114 13.4 Lg | 117 9.6 Pt | T PEG |
| S CYG | 127 7.6 Wb | 126 9.5 Pt | 117 13.3 Lg | X PEG | 220412 |
| 200357 | 128 7.2 Jo | 127 9.4 Pt | 119 13.6 Cb | 211614 | 114[11.7 Ch |
| 110[12.4 Ch | 129 7.5 Sp | 128 8.8 Pt | 119 13.2 Lg | 117 11.0 Pt | S GRU |
| 115 12.4 Pt | 139 7.3 Jo | 129 8.9 Pt | 125 13.1 Lg | T CAP | *221948* |
| R CAP | R DEL | 130 8.8 Pt | 126 13.0 Lg | *211615* | 080 12.0 En |
| *200514* | 201008 | 134 8.8 Pt | 140 11.6 Ca | 087[12.7 Bl | 083 12.1 En |
| 115 13.4 Pt | 115 13.1 Pt | 135 9.0 Pt | RZ CYG | 113[11.3 Ch | 092 12.4 En |
| SV CYG | 116 13.6 L | 136 9.4 Pt | 204846 | S MIC | S LAC |
| 200647 | RT CAP | 137 9.6 Pt | 112 10.7 Ie | *212030* | 222439 |
| 117 9.0 Rt | *201121* | 138 9.6 Pt | 117 10.2 Pt | 087 12.5 Bl | 114 9.5 Ch |
| S AQL | 115 7.0 Pt | ST CYG | S IND | Y CAP | 117 7.7 Pt |
| 200715a | 117 7.3 Rt | 202954 | *204954* | *212814* | 128 7.7 Ie |
| 094 9.1 Ch | SX CYG | 117 10.8 Pt | 087 11.0 Bl | 087[12.9 Bl | 132 8.0 Cl |
| 107 9.4 Ch | 201130 | 128 10.2 Ie | R VUL | 113[10.6 Ch | R IND |
| 109 9.5 Lg | 115 12.6 Pt | V VUL | 205923 | W CYG | *222867* |
| 114 9.6 Lg | RT SGR | 203226 | 110 8.5 Ch | 213244 | 087 11.9 Bl |
| 115 9.5 Pt | *201139* | 117 8.7 Pt | 117 8.8 Pt | 060 5.7 Go | T TUC |
| 117 9.5 Lg | 087 11.9 Bl | R MIC | 118 9.3 Jo | 081 6.5 Go | *223462* |
| 119 9.7 Lg | WX CYG | *203429* | 128 9.9 Jo | 098 6.4 L | 093 11.1 En |
| 122 9.6 Lg | 201437b | 087 13.8 Bl | 139 10.8 Jo | 116 6.6 L | R LAC |
| 125 9.7 Lg | 115 12.5 Pt | Y DEL | RS CAP | 120 6.6 L | 223841 |
| 126 9.7 Lg | U CYG | 203611 | *210116* | 122 5.7 Go | 114[11.8 Ch |
| 128 9 5 Cl | 201647 | 119[13.0 Bl | 117 8.1 Rt | 127 5.7 Go | RW PEG |
| RW AQL | 107 10.8 Ch | S DEL | V CAP | S CEP | 225914 |
| 200715b | 117 8.7 Pt | 203816 | *210124* | 213678 | 117 12.1 Pt |
| 109 9.0 Lg | 117 8.6 Cb | 117 9.2 Pt | 087[13.0 Bl | 114 9.6 Ch | R PEG |
| 114 9.2 Lg | 118 8.9 Jo | 122 9.2 Cl | TW CYG | 117 8.4 Pt | 230110 |
| 115 9.3 Pt | 124 10.3 Cb | V CYG | 210129 | 140 8.8 Jo | 109 9.5 Lg |
| 117 9.1 Lg | 128 9.1 Jo | 203847 | 128 10.5 Ie | RU CYG | 112 9.5 Kl |
| 119 9.1 Lg | 128 10.0 Sp | 110 11.7 Ch | X CAP | 213753 | 114 9.6 Ch |
| 122 9.0 Lg | | 117 11.8 Pt | *210221* | 094 8.0 Ch | 114 9.5 Lg |
| 125 8.9 Lg | | | 087[13.0 Bl | 117 7.9 Pt | 117 9.5 Lg |

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1927.

| J.D. | Est. | Obs. | J.D. | Est. | Obs. | J.D. | Est. | Obs. | J.D. | Est. | Obs. | J.D. | Est. | Obs. | J.D. | Est. | Obs. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **R PEG** | | | **V CAS** | | | **W PEG** | | | **ST AND** | | | **R AQR** | | | **R CAS** | | |
| 230110 | | | 230759 | | | 231425 | | | 233335 | | | *233815* | | | 235350 | | |
| 117 | 9.6 | Rt | 117 | 7.6 | Pt | 128 | 8.2 | Jo | 099 | 8.8 | Ch | 087 | 8.2 | Bl | 114 | 6.2 | Ch |
| 117 | 9.6 | Pt | 120 | 7.8 | Ca | **S PEG** | | | 109 | 9.0 | Lg | 099 | 8.7 | Pt | 118 | 6.7 | Jo |
| 119 | 9.3 | Kl | 129 | 7.9 | Jo | 231508 | | | 114 | 8.7 | Lg | 129 | 8.7 | Ca | 120 | 6.8 | Ca |
| 119 | 9.4 | Lg | 135 | 7.6 | Ca | 114 | 7.8 | Ch | 117 | 8.7 | Lg | **RR CAS** | | | 128 | 6.5 | Jo |
| 122 | 9.5 | Lg | **W PEG** | | | 117 | 7.7 | Pt | 117 | 8.5 | Pt | 235053 | | | 139 | 7.2 | Jo |
| 123 | 9.5 | Kl | 231425 | | | **RY CEP** | | | 119 | 8.7 | Lg | 114[ | 10.2 | Ch | 140 | 6.6 | Ca |
| 125 | 9.4 | Lg | 099 | 9.8 | Ch | 231878 | | | 122 | 9.2 | Lg | **V CET** | | | **Z PEG** | | |
| 126 | 9.5 | Lg | 112 | 9.1 | Kl | 114 | 9.3 | Ch | 125 | 8.9 | Lg | *235209* | | | 235525 | | |
| 129 | 9.7 | Ca | 117 | 9.0 | Kl | **Z AND** | | | 125 | 9.2 | Ca | 087[ | 12.8 | Bl | 117 | 7.9 | Pt |
| **V CAS** | | | 119 | 9.0 | Kl | 232848 | | | 126 | 9.1 | Lg | 100 | 14.2 | L | **SV AND** | | |
| 230759 | | | 122 | 8.7 | Kl | 099 | 9.7 | Ch | | | | 122[ | 13.6 | L | 235939 | | |
| 114 | 7.8 | Ch | 123 | 8.8 | Kl | 117 | 9.6 | Pt | | | | | | | 117 | 11.6 | Pt |

RAPIDLY VARYING IRREGULAR VARIABLES.

| Star | J.D. | Est. | Obs. | J.D. | Est. | Obs. |
|---|---|---|---|---|---|---|
| 005840 RX ANDROMEDAE— | | | | | | |
| | 5113.8[ | 12.4 | Pt | 5124.7[ | 12.4 | Pt |
| | 5114.7[ | 12.4 | Pt | 5125.8[ | 12.4 | Pt |
| | 5115.7[ | 12.4 | Pt | 5126.7[ | 11.7 | Pt |
| | 5117.7 | 11.3 | Pt | 5127.7[ | 12.4 | Pt |
| | 5118.7 | 11.4 | Pt | 5128.8[ | 12.4 | Pt |
| | 5119.8 | 11.5 | Pt | 5129.7[ | 11.0 | Pt |
| | 5120.7 | 11.8 | Pt | 5137.7[ | 11.7 | Pt |
| | 5121.8[ | 12.4 | Pt | 5138.7 | 13.0 | Pt |
| 060547 SS AURIGAE— | | | | | | |
| | 5100.6[ | 14.5 | L | 5125.8[ | 12.4 | Pt |
| | 5119.8[ | 12.4 | Pt | 5126.8[ | 13.3 | Lg |
| | 5122.6[ | 14.5 | L | 5147.7[ | 11.0 | Pt |
| | 5124.8[ | 12.6 | Pt | 5128.8[ | 12.6 | Pt |
| 074922 U GEMINORUM— | | | | | | |
| | 5122.6[ | 13.3 | L | 5124.9[ | 13.3 | Pt |
| 213843 SS CYGNI— | | | | | | |
| | 5089.2 | 11.6 | Ch | 5109.3 | 11.1 | L |
| | 5094.1 | 11.6 | Ch | 5110.1 | 11.2 | Ch |
| | 5094.4 | 11.2 | L | 5110.4 | 10.9 | L |
| | 5098.4 | 11.2 | L | 5110.4 | 10.6 | Kl |
| | 5099.4 | 10.7 | L | 5110.4 | 11.0 | Be |
| | 5099.4 | 10.7 | Be | 5110.7 | 11.7 | Pt |
| | 5100.6 | 11.1 | L | 5111.1 | 11.0 | Ch |
| | 5101.2 | 11.3 | Ch | 5111.4 | 10.0 | L |
| | 5108.7 | 11.7 | Pt | 5112.4 | 8.7 | Kl |
| | 5109.3 | 11.1 | Be | 5112.6 | 8.6 | Ie |
| 213843 SS CYGNI— | | | | | | |
| | 5113.1 | 8.3 | Ch | 5123.6 | 8.5 | Lv |
| | 5113.4 | 8.7 | Kl | 5123.7 | 9.3 | Pt |
| | 5113.8 | 8.6 | Pt | 5124.4 | 8.9 | Kl |
| | 5114.1 | 8.7 | Ca | 5124.7 | 9.4 | Pt |
| | 5114.1 | 8.3 | Ch | 5125.0 | 9.2 | Ca |
| | 5114.4 | 8.4 | Kl | 5125.8 | 9.5 | Pt |
| | 5114.7 | 8.9 | Pt | 5126.7 | 10.3 | Pt |
| | 5115.2 | 8.3 | Ch | 5127.7 | 10.4 | Pt |
| | 5115.7 | 8.9 | Pt | 5128.5 | 11.3 | Ie |
| | 5116.2 | 8.2 | Ch | 5128.6 | 10.8 | Cl |
| | 5116.3 | 8.6 | L | 5128.8 | 11.3 | Pt |
| | 5116.4 | 8.7 | Be | 5129.1 | 11.1 | Ca |
| | 5117.4 | 8.5 | Kl | 5129.7 | 11.8 | Pt |
| | 5117.7 | 8.9 | Pt | 5130.6 | 11.6 | Ie |
| | 5118.7 | 9.0 | Pt | 5130.7 | 11.8 | Pt |
| | 5119.4 | 8.5 | Kl | 5132.6 | 11.9 | Cl |
| | 5119.8 | 9.1 | Pt | 5132.6 | 11.9 | Cl |
| | 5120.2 | 8.4 | Ca | 5134.7 | 11.7 | Pt |
| | 5120.4 | 8.8 | L | 5135.7 | 11.7 | Pt |
| | 5120.7 | 9.0 | Pt | 5136.7 | 11.8 | Pt |
| | 5121.4 | 8.5 | Kl | 5137.7 | 11.7 | Pt |
| | 5121.8 | 9.0 | Pt | 5138.0 | 11.5 | Ca |
| | 5122.4 | 8.5 | Kl | 5138.7 | 11.7 | Pt |
| | 5122.6 | 8.6 | Cl | 5140.0 | 11.5 | Ca |
| | 5123.1 | 8.7 | Ca | 5140.6[ | 11.2 | Ya |
| | 5123.3 | 8.7 | Kl | 5141.6 | 12.1 | Cl |
| | 5123.3 | 8.7 | L | | | |

Total observations, 1286; Total variables, 330; Total observers, 26.

LEON CAMPBELL, Recording Secretary.

October 6, 1927.

## METEOR NOTES.

By CHARLES P. OLIVIER.

Nearly every issue of an astronomical journal contains one or more observations of some brilliant meteor or fireball. These are usually made by amateurs, but sometimes by professional scientists. As it is quite as easy to send in for

publication the data that will be of service to men who will wish to use such observations for theoretical work on meteors, the following is published in the hope that such contributors will make an effort to follow in general the directions given. Because, as it is, over half of the published accounts of such objects are utterly worthless for any scientific purpose whatsoever.

An outline of the things involved should help. So it must be understood that the most important data are always the date and time at which the phenomenon took place, the coördinates of the beginning and ending points, and the duration of the flight. With these facts in mind the following remarks should be easy to follow.

The time of the phenomenon can always be determined by the watch of the observer. If he thinks this is in error, he can easily check it up by the noon telegraphic signals next day, so that in no reasonable case should he be off more than a minute in his record. Next, assuming that the phenomenon takes place after dark, he should attempt to fix the beginning and ending points of the path by means of the stars nearest thereto. It should later be plotted on a star map and the right ascensions and declinations of the points be measured off by a scale. If he is unfamiliar with the constellations, the next best thing to do is to get the altitudes and azimuths of the points in question, though this can rarely be done with the accuracy of the first method. To secure these coördinates he should carefully note where he is standing, and the points desired in the sky with regard to trees, poles, buildings, or some other lofty object. Lacking these he must do it by mere estimation. Returning by daylight with a compass he can easily get the approximate azimuths of the points desired. As to the altitudes he must either use a theodolite, or some simple home made instrument for getting vertical angles. These can be made with a few minutes' work and are usually quite accurate enough for the purpose, as one's recollection of the desired points will never be any too certain. An estimate of the slope of the path with regard to the horizon is a good check and should always be made.

For daylight fireballs, which are occasionally seen, the method just outlined will hold. In fact it is the only one, as the stars are not available for reference points. As to the duration of the flight, *i.e.* the actual number of seconds the body took to pass along its path, this is far the most difficult of all to observe accurately. If one can remember to repeat some familiar verse of poetry, of doggerel, and then later with a watch repeat the same and time himself it is the best way. But it is very difficult to remember to do this as one is always caught unprepared. So again the best estimate one can give, written down when the whole thing is fresh in the mind, has usually to serve.

When these four fundamental data have been observed, then one should record the less important which include color, length and duration of train, if there was any slowing up of the motion, any curvature of path, how large compared to moon or planets the object appeared, if it exploded, and anything else of interest. (The use of feet and inches in such descriptions is inexcusable in any person who pretends to know the least thing about astronomy.) If there was an explosion, or any sound phenomenon whatever connected with the object, the interval until it is heard should be carefully noted, as well as how long the sound continued. If the train persists, drawings of it showing the amount and direction of drift should be made at intervals.

If all the brilliant meteors seen by persons interested in astronomy were noted by them and these directions approximately followed each year we would have

a large number of accurate heights of such objects, and in many cases orbits, to add to our catalogues. Such data would permit a rapid advance in a field that due to negligence of such opportunities is sadly lacking. It is very difficult to convince persons how valuable these observations are and what important theoretical problems depend upon them for their solution. The writer therefore urgently requests that all readers will try to keep this fact in mind, because most of us will not see a really brilliant meteor more often than once per year, on an average, unless we are actually making meteor observations, so the time needed to make the desired notes will never prove a burden to any individual. And if he will take this trouble he may be sure that something worth while has been done. Perhaps the warning should be added that if one can observe only a few of the data desired, he should still report them by all means, for they may be just the ones needed most in a solution, when compared with data from others.

Many brilliant fireballs appeared this past summer, for instance, and for a few of them enough data are at hand to attempt computations. But due to the lack of enough observations by persons who knew the constellations, and who therefore could refer the end points to stars, in no case will the results be of a high accuracy. This is but another reason, which can be added to many others, why the constellations should be learned by all educated people. It is a very easy thing to do; the brighter stars can be mastered in a few hours by anyone, and it is hard to think of a way in which more satisfaction will reward a moderate effort. As several amateur astronomical societies have recently been founded, it is hoped that their members particularly will pay some attention to the above remarks.

Leander McCormick Observatory,
University of Virginia, 1927 Oct. 19.

## COMMUNICATIONS.

**Bright Meteor.**—At 9:18 P.M., October 15, I saw an unusually bright meteor, attaining almost the proportions of a fireball, which made its appearance between Aurigae and the Pleiades, and in going west went directly over the zenith and disappeared in Hercules, the approximate position of the disappearance being R.A. $17^h$, Decl. $+20°$.

The meteor was about as bright as the planet Jupiter now appears, and left a train of sparks behind it 4° or 5° in length. Its path of 100° or more was traversed in three or four seconds, and its general course was almost directly from east to west. This was observed in the city of Providence, R. I.

RALPH C. PATTON.

**The Variable $\epsilon$ Aurigae.**—This star is of the Algol type and undergoes an eclipse lasting 700 days with 340 days of constant light at minimum. Ludendorff's elements, Min. $= 2415850 + 9900$ E, indicate a minimum for April, 1929. The beginning of the eclipse is for April, 1928, and the end April, 1930. The slow variability from magnitude 3.3 to 4.1 permits the star to be observed by amateurs, with no need of instruments, such as are needed for a Mira Ceti type variable. These observations published by each person, as he is accustomed, in any magazine he chooses, would be of great help in testing the elements given above. It would be wise not to delay observations of this star longer, so as not

to miss the beginning of the eclipse in case of an unexpected advance on the ephemeris. An important study of this Algol type variable star, exceptional because of its long period (27 years), would be of great interest.

J. ELLSWORTH.

49 Avenue de Noailles, Lyon, France.

---

**Pons-Winnecke Comet Observed.**—At Binghamton, N. Y., I observed the Pons-Winnecke comet three nights without optical aid. About 10:00 P.M., E.S.T., June 24, I first saw it in Vulpecula approximately five degrees northeast of $\gamma$ Sagittae. The comet covered an area about a degree in breadth and seemed equal in brightness to the brighter parts of the Milky Way.

At 10:30 P.M., June 26, the comet was between $\alpha$ and $\epsilon$ Equulei, and during a period of two hours I noticed that it was moving southeast among the stars at the rate of nearly half a degree per hour.

About 1:00 A.M., June 29, I saw the comet for the last time near $\iota$ Aquarii, still plainly visible although not so bright as before.

HAROLD P. SPEARS.

19 Andrews Ave., Binghamton, N. Y., Oct. 10, 1927.

---

## GENERAL NOTES.

**A Request.** — The demand for copies of certain issues of POPULAR ASTRONOMY, notably those of January, May, and August-September of the current year, has been so great that the reserve supply is practically exhausted. As requests for these numbers are still being received we should like to obtain copies of these issues. Many of our readers keep complete files of this magazine, although we do not flatter ourselves to the extent of thinking that all do so. It is possible, therefore, that some may be willing to return their copies to us. We shall be glad to pay fifty cents in cash for each of the first ten copies of any of the numbers mentioned or, if preferred, to extend subscriptions for two issues.

---

**Dr. George Andrews Hill,** senior astronomer at the U. S. Naval Observatory, Washington, died on August 29, aged sixty-nine years. (*Nature,* October 8, 1927.)

---

**Dr. Robert A. Millikan,** director of the Norman Bridge Laboratories of the California Institute of Technology, will give a course of six Lowell lectures in Boston beginning on April 13, 1928. His subject will be "Twentieth Century Discoveries in Physics." (*Science,* September 16, 1927.)

---

**Miss Sarah F. Whiting,** who was connected with the departments of physics and astronomy at Wellesley College from 1879 to 1916, died on September 12. An account of her scientific accomplishments, prepared by Miss Annie J. Cannon, will appear in the December issue of this magazine.

---

**Professor E. W. Brown,** of Yale University, has accepted the invitation of the American Mathematical Society to give the fifth Josiah Willard Gibbs lecture in connection with the meetings of the society and of the American Associa-

tion for the Advancement of Science at Nashville, Tennessee, in December, 1927. (*Science*, September 16, 1927.)

**Professor Albert A. Michelson,** of the University of Chicago, left on September 24 for Pasadena, with the object of repeating at the Mount Wilson Observatory the Michelson-Morley experiment. Dr. Michelson will also make a further study of the speed of light. (*Science*, September 30, 1927.)

**The University of Munster** has conferred an honorary doctorate on Johann Georg Hagen, director of the Vatican Observatory, on the occasion of his eightieth birthday. (*Bulletin of the American Mathematical Society*, September-October, 1927.)

**The Franklin Institute** has awarded Franklin Medals and certificates of honorary membership to Professor Max Planck, of the University of Berlin, and to Dr. G. E. Hale, honorary director of the Mount Wilson Observatory. (*Bulletin of the American Mathematical Society*, September-October, 1927.)

**Observatory at Bloemfontein.** — The project of establishing an observatory at Bloemfontein, South Africa, by the University of Michigan is nearing completion. The building proper is finished and the dome is on the ground. Mr. Morris K. Jessup and Mr. Henry F. Donner, both of the University of Michigan, left New York for Bloemfontein in October. They will be members of the staff of the new observatory with Dr. R. A. Rossiter, who will be in charge.

**On an Apparent Decrease in the Velocity of Light.**— This is the title of a paper by M. E. J. Gheury de Bray, of Eltham, England, which has been quoted widely in astromonical journals recently. The most extended discussion we have noticed is to be found in *Astronomische Nachrichten* 5520, **230**, 449. In this place the author has tabulated the seven most reliable determinations of the velocity of light in a vacuum in the order in which they were made, as follows (T.W. = Toothed Wheel; R.M. = Revolving Mirror):

| Name | Method | Length of Base | Date | km/sec. |
|---|---|---|---|---|
| Cornu (Listing) | T.W. | 22910 m. | 1874.8 | 299990 ± 300 |
| Michelson (I) | R.M. | 1986 ft. | 1879.5 | 299910 ± 50 |
| Newcomb | R.M. | 3721 m. | 1882.7 | 299860 ± 30 |
| Michelson (II) | R.M. | 2050 ft. | 1882.8 | 299853 ± 60 |
| Perrotin | T.W. | 45951 m. | 1901.4 | 299880 ± 50 |
| Michelson (III) | R.M. | 35385 m. | 1924.6 | 299802 ± 30 |
| Michelson (IV) | R.M. | 35385 m. | 1926.0 | 299796 ± 4 |

One notices at once the decrease in the velocity from the first to the last item in the table. It is this which the author stresses in his discussion. He also grouped the second, third, and fourth together as those for which the base line was less than four kilometers, and the remaining ones as those for which the base line was more than twenty kilometers. A decrease similar to that noticed in the series as a whole is evident also in each of the sub-groups. The author feels that such regularity of change cannot be attributed to mere coincidence. He mentions two explanations for it: first, an actual decrease in the velocity of light; second, a variation in the unit of time. He shows, however, that the latter is extremely im-

probable. "The determinations which Professor Michelson is making actually over a base of 131 kilometers in length, between Mt. Wilson and Mt. San Jacinto, though throwing more light on the question, can hardly be hoped to be decisive, as the interval elapsed since his last observations is too small.

"The writer has only considered the case of a continuous decrease of velocity. If one is willing to admit that the velocity oscillates, the problem is evidently simplified. . . . Such an oscillation, however, appears much more difficult to accept and to explain, than a continuous variation."

---

**Southern Cross Observatory.** — The increasing work of the Southern Cross Observatory at Miami, Florida, finds a call for aid going out to amateur astronomers throughout the country in a letter received from James J. Marshall, secretary. The society which is composed of interested observers from many states in the Union is equipped with six 5-inch Clark refractors given by S. Lynn Rhorer of Atlanta, which are open to the public during the three months of the season commencing January 1. These are placed in the new Bayfront Park and are visited nightly by crowds of visitors, which have reached as high as a thousand on a single evening. A number of informed persons are required to be in attendance at the telescopes, to take charge of special groups of school and society organizations, and to give the fifteen minutes lectures which form a feature of each evening's work.

The lecture in the city's largest auditorium given by an astronomer of national prominence each February will be repeated this year. Dr. Harlow Shapley addressed large audiences in 1925 and 1926, while last year Dr. E. B. Frost of Yerkes spoke to forty-five hundred people. All of the services rendered by the members of the staff is free to the public.

It will be of interest to the reader to know that Alpha Crucis, the most southern first magnitude star is above the Miami horizon. The winter season brings into view Achernar, Canopus, the southern cross, Alpha Centauri and Beta Centauri.

The secretary, James J. Marshall, 807 Biscayne Bank Building, Miami, will be pleased to correspond with interested astronomers.

---

## BOOK REVIEW.

**The Common Sense of the Theory of Relativity** by Paul R. Heyl, Williams Wilkins Company, Baltimore, Md.

This small volume of 44 pages, a reprint from the December, 1923, issue of the *Scientific Monthly*, contains a very suggestive presentation of this much talked of but little understood subject. It is brief enough so that one can read it at one sitting and thus have the benefit of a continuous line of thought. Obviously many of the intricacies and refinements are lacking, although the impression one has on finishing the book is that the writer fully comprehends the topic he discusses, and that one has, at least to a certain extent, glimpsed the meaning of this puzzling principle.

C. H. G.